LARGEST TELEPHONE CIRCULATION IN THE WORLD.

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Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

VOLUME II. NUMBER 4. CHICAGO, OCTOBER, 1901. TEN CENTS A COPY. ONE DOLLAR A YEAR.

INDEPENDENT WIRE TELEPHONE SUPPLY COMPANY
TELEPHONE CONSTRUCTION SPECIALTIES AND SUPPLIES
19 SOUTH CANAL STREET, CHICAGO.

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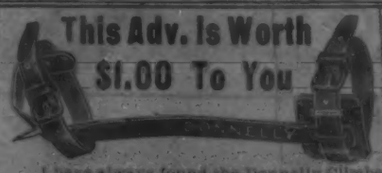

If you mention this paper. If you will send a Postal Money Order for $2.00 we will send you a pair of Donnelly Steel Climbers and give you a $1.00 set of straps with pads. Each spur is oil tempered by the Wallace Barnes Co. and warranted by us. Testimonial of the Grand Treasurer of the Int. Brotherhood of Electrical workers:

I have always found the Donnelly Climbers satisfactory. I have used them and can recommend them as second to none. P. J. SHEEHAN, Hartford, Conn.

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MAGNETO BELLS.
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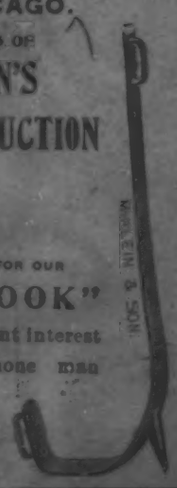

WRITE TO-DAY FOR OUR
"RED BOOK"
It is of pertinent interest to every telephone man and will be sent free upon request.

E. M. VAN DUZEE JR. & CO.
Fifth and Jackson Sts., St. Paul, Minn.
Telephones and Telephone Supplies.
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1259 MONADNOCK BUILDING
CHICAGO, ILLINOIS.
WRITE FOR OUR REFERENCES.

MAKERS OF
Telephones AND Switchboards.
LA CROSSE, WIS. U. S. A.

Alphabetical Index to Advertisers, Page XIX.

Big Talk? Yes, efficient Apparatus.

It may have occurred to the readers of Telephony that we have been doing some big talk about our Switchboards, Telephones, and other devices.

We have. IT'S UP TO US to prove that it is true.

We will be glad to give you the names of some of the largest and most successful Independent Exchanges that are equipped with EUREKA apparatus, all giving the very best possible service in all parts of the United States, and we should be glad to have an opportunity of visiting you, and explaining the many advantages of EUREKA apparatus over all competition on our positive guarantee that it will do all we claim.

Now, if you don't believe us, IT'S UP TO YOU.

THE EUREKA TRANSMITTER, PERFECT IN ARTICULATION, HANDSOME IN DESIGN, SIMPLE ADJUSTMENT, ADAPTABLE TO ALL EXCHANGE REQUIREMENTS.

THE EUREKA GENERATOR, THE MOST POWERFUL MAGNETO GENERATOR OBTAINABLE IN THE INDEPENDENT FIELD.

THE EUREKA RECEIVER, ALWAYS IN PERMANENT ADJUSTMENT, ALWAYS READY FOR THE MOST EXACTING SERVICE. SOLID TUNGSTON STEEL MAGNETS SOLID RUBBER SHELLS.

THESE ARE SOME OF THE FEATURES IN THE CONSTRUCTION OF OUR TELEPHONES.

300 CAPACITY EUREKA EXPRESS WITH FLASHLIGHT TRANSFER.

Switchboards built in all capacities. Toll Line Switchboards. Protective Devices.

The minimum number of operations to make connection. One operation less than any other board on the market.

Send for Catalogue and write us for prices. Our Catalogue contains useful and necessary information for all exchanges.

EUREKA ELECTRIC CO.

143 to 149 SOUTH CLINTON STREET, CHICAGO, ILL., U. S. A.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

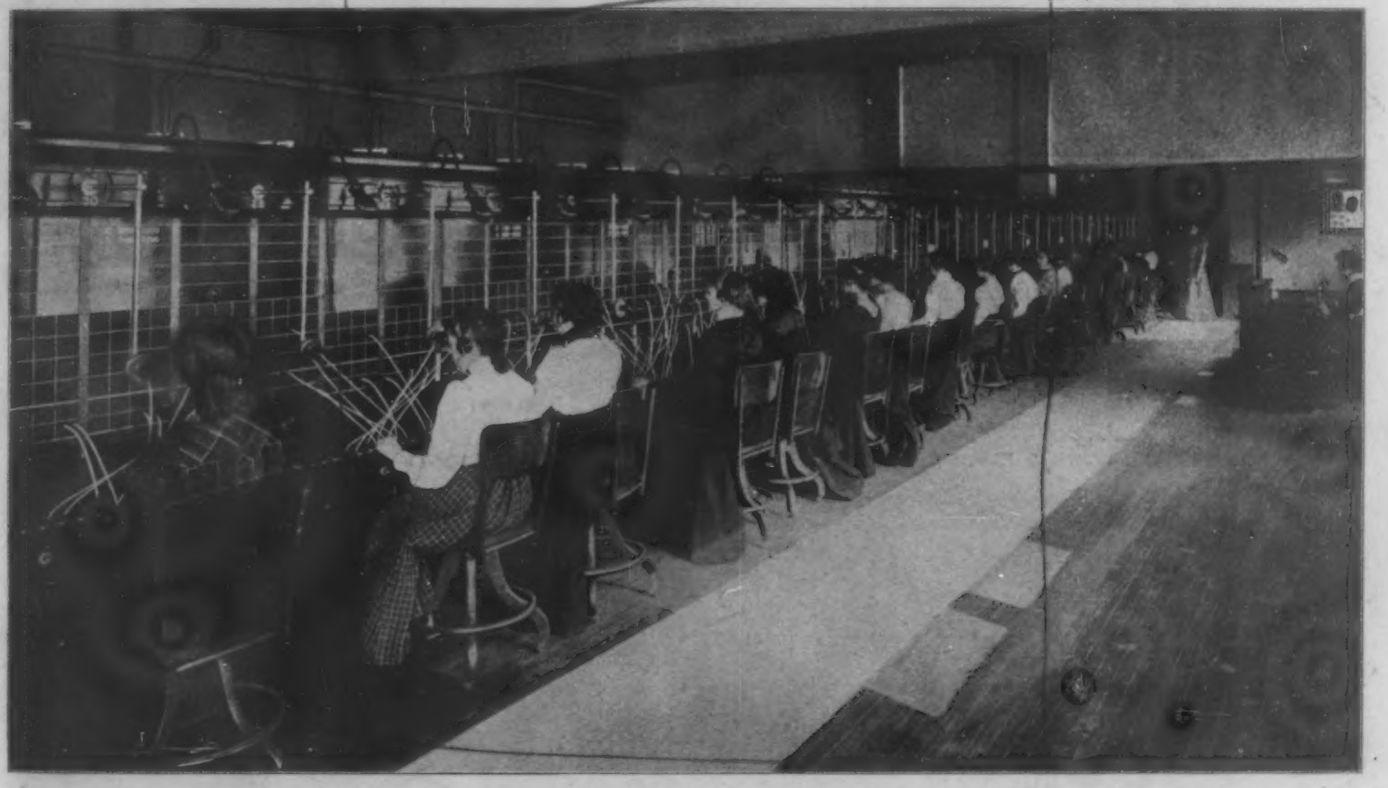
VOL. II. CHICAGO, OCTOBER, 1901. No. 4.

THE TELEPHONE STORY OF MISSOURI.

BY JAMES S. CUMING.

The story of telephony in Missouri begins with the sending of two receivers to St. Louis in the year 1878 and the construction of a single line from the downtown district to the Fair Grounds, a distance of about four miles. From this beginning the Bell Telephone Company of Missouri was organized and remained in undisputed possession of the field until 1894, or a period of sixteen years. During this time the Bell Telephone Company erected exchanges in St. Louis, Kansas City, Springfield, St. Joseph, Sedalia, Hannibal and a few smaller cities, with suburban connection the exception instead of the rule. No attempt at long distance service or even connection between the different cities of the state was made until the organization of the American Telegraph and Telephone Company and the majority of new stations have only been reached within the last year.

Our story, however, is not to deal with the progress of the Bell Telephone Company, for if it were we could truly say: "A short horse is soon curried," and the tale is told above. In all the history of various business enterprises there is no equal to the inactivity and neglect of opportunities shown by this company, which enjoyed the greatest monopoly the world has ever known, and it remained for the practical business man of no experience in telephony to open the eyes of the sleeping monopoly and make a public necessity of the instrument which to this time had only been a luxury to the rich. Up to the advent of independent telephones in Missouri the total number of instruments in this state amounted to less than 20,000. To-day there are over 70,000 independent telephones in use in Missouri and only three important points (Kansas City, Springfield and Hannibal) that are not served with independent telephones. Kansas City and Springfield both have applications for independent franchises under consideration and the outlook is, will soon have independent exchanges built.



DIVISION "A" OF THE SWITCHBOARD, KINLOCK TELEPHONE COMPANY, ST. LOUIS, MO.

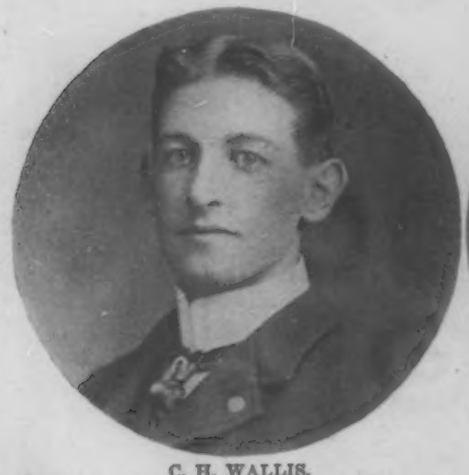
Missouri is a pioneer state in independent telephony and while we can boast of the first large installation of an independent telephone exchange in the United States, we can point with pride to the small exchanges who had nerve to go on, and against threats of all sorts and with little knowledge of telephony, but a determina-

tion to show that good business methods would win, prove to the world that independent telephony is a practical and profitable enterprise. St. Charles, De Soto, Chillicothe, Louisiana and Mexico, Mo., all had independent telephone exchanges installed prior to 1895 and Iowa from this state. On the east side there are submarine cables crossing the Mississippi River at West Quincy, Louisiana, Winfield and Bird's Point, besides several overhead wires and the cables of the Kinloch Long Distance Telephone Company connecting St. Louis

E. W. CULVER, JR.,
Treas. Culver Lumb. & Mfg. Co., Kansas City.

JAMES S. CUMING,
Prest. Central Tel. & Elec. Co., St. Louis, Mo.

D. A. KUSEL,
Proprietor The D. A. Kusel Tel. & Elec. Mfg. Co.

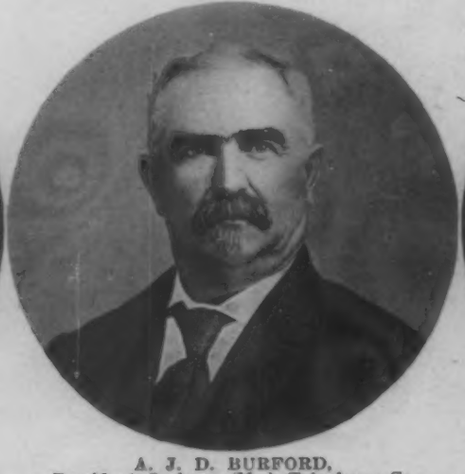


C. H. WALLIS,
Western Salesman Central Tele. & Elec. Co.

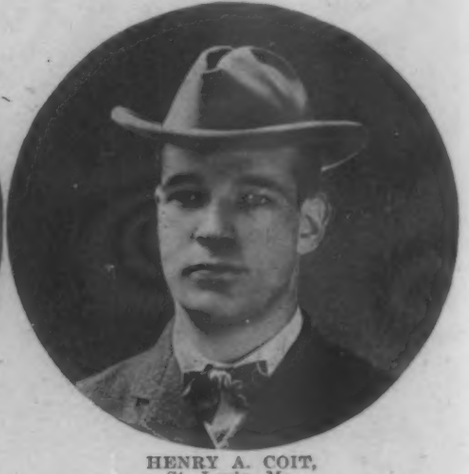
J. A. BECKER,
Supt. Central Tel. & Elec. Co., St. Louis, Mo.

M. E. MARTIN,
Secy.-Treas. Central Tel. & Elec. Co., St. Louis.

V. S. SMITH,
Owner Bowling Green (Mo.) Telephone Co.



A. J. D. BURFORD,
President Jackson (Mo.) Telephone Co.



HENRY A. COIT,
St. Louis, Mo.

all of these have increased beyond the greatest expectations of their original builders. There is no section of Missouri that has been neglected by the independent telephone interests and connections into other states are made at numerous points. On the northern boundary it is estimated that there are at least 100 lines reaching into to numerous cities and towns in Illinois. On the south there are lines into Arkansas from Malden, Doniphan, West Plains, Springfield and Cassville, and on the west lines into Indian Territory, Kansas and Nebraska, originating in over twenty exchanges in this state.

The farmers in Missouri have not been neglected and

to use the words of Mr. Theo. Gary, president of the Macon Telephone Company, Macon, Mo., and secretary of the Independent Telephone Association of Missouri: "We must take care of the farmers or they will take care of us." The Macon exchange will well illustrate the difference between Bell telephone and independent telephone business methods. The Bell Company considered this town too small for an exchange to pay and therefore made no effort to secure a franchise here until after the Macon Telephone Company had demonstrated what could be done. The Macon exchange was originally installed in 1896 and was purchased by the present owners in February, 1898. It then had a list of 151 subscribers. This exchange now has 455 subscribers, with a population of 4,068 to work on, or a telephone for each nine inhabitants of the city. They also have connected to their switchboard and a part of their system 850 telephones in Macon County outside of the city. This company charges only $1 per month for residences and $2 per month for business houses and are able to pay dividends of 6 per cent semi-annually, besides laying by a surplus for repairs and extensions.

H. E. RALSTON,
Mgr. Hanamo Toll Line Co., Maitland, Mo.

HOWARD ELLIS,
Secy.-Treas. People's Tel. Co., New Florence, Mo.

T. M. MARLOW,
Prest. People's Telephone Co., New Florence, Mo.

AARON D. STATES,
Greenfield, Mo.

J. H. ANDERSON,
Supt. Booneville (Mo.) Telephone Co.

G. G. YOUNGBLOOD,
Manager Republic (Mo.) Telephone Co.

W. H. McGLUMPHY,
Manager Kingston (Mo.) Telephone Co.

L. E. JEANNIN,
Supt. Webb City (Mo.) Telephone Co.

J. H. CLAWSON,
Secy.-Treas. Humphrey (Mo.) Switchboard Co.

Among other prominent independent telephone companies in Missouri may be mentioned the Citizens' Telephone Company, St. Joseph, Mo., with 1,500 telephones in use, with numerous well-constructed toll lines, giving connections to all important points in Northwest Missouri and Northeastern Kansas. The Joplin Telephone Company has 1,200 telephones in the city of Joplin and by traffic arrangements with other companies in this section, give free service to subscribers to Carthage, Mo., Webb City, Mo., and Galena, Kan. These four exchanges having 2,500 subscribers. Capitol Telephone Company, Jefferson City, Mo., one of the recent exchanges installed, now has over 300 telephones in use. One year ago the Bell Company had about 200 subscribers in this city, without competition, and now have hardly sufficient to call it an exchange at all. Queen City Telephone Company, Sedalia, also one of the recent installations, now have over double the number of subscribers that the Bell had in this city and are having no trouble in holding their customers and adding new ones. Louisiana Telephone Company, Louisiana, Mo., has now run the Bell entirely out of their local business and have over 400 telephones in Louisiana and 250 miles of metallic circuit toll lines, all paying a handsome return on the investment.

The largest independent telephone system in Missouri, and, in fact, the largest in the world, is the Kinloch Telephone Company, which was organized December 5, 1896, by Mr. Hopkins J. Hanford, who has been prominent in the organization of several other large independent companies and is still pushing the good work along. This company has a full paid capital stock of $2,000,000 and an authorized bond issue of like amount. The bonds sell at a premium on the market and the stock is not for sale. One of the conditions offered by this company in soliciting subscribers was that there would be no charge until 4,000 subscribers were in actual working operation, and to-day the company has a paid circulation list of almost 7,000. The construction work in this exchange is the best that money could obtain, the entire business portion of the city being installed underground. The apparatus originally installed has been changed considerably wherever better service could be obtained by so doing, and under the able management of Mr. H. Linton Reber, the chief engineer of this company, the service has been greatly improved and will now compare favorably with any exchange, either Bell or independent. The Kinloch Long Distance Telephone Company was organized about one year ago by Mr. Chas. H. Ledlie, formerly the chief engineer for the Kinloch Telephone Company, and while the two companies are separate corporations, the stockholders are practically the same and the purpose of the long distance company is to supply outside connections with practically every point within a radius of 100 miles of St. Louis; and when our neighbors at the other end of the drainage canal have their independent exchange in operation St. Louis will be able to meet them more than half way.

Only a small part of the progress made by independent telephone companies in Missouri can be briefly referred to in this article, but Missouri can assure the world, she has not been asleep in this great enterprise, and though our watchword is: "You have to show us," I will conclude by extending a hearty welcome to all telephonists to St. Louis World's Fair in 1903, and "We will show you."

THE STOMBAUGH GUY ANCHOR.

Another good thing from Missouri is the Stombaugh Guy Anchor. This is not made in Missouri, but is distributed from there by W. N. Matthews & Bros., of St. Louis. Through their enterprise and push this valuable contrivance has become so widely known that it is in everyone's thoughts.

WESTERN ELECTRICAL SUPPLY COMPANY, ST. LOUIS.

In the city of St. Louis, Mo., at the corner of Seventh and Clark avenue, stands a very substantial five-story and basement brick building, occupied by the Western Electrical Supply Company.

The half-tone of the building shown gives one a fair idea of its general appearance, but not of its size. The building was erected for this company in the past year, and contains every modern appliance necessary for the rapid and intelligent handling of the electrical business, and is said to be the most complete occupied by any electrical jobber in the country.

The building was erected under plans and specifications approved by this company. The walls are extremely heavy, the floors and columns being calculated to carry heavy loads; the upper floors are fitted up with shelving, bins and cases

BUILDING WESTERN ELECTRICAL SUPPLY CO., ST. LOUIS, MO.

which contain all kinds of electrical apparatus and appliances, while the first floor is divided into general offices and the shipping department.

The company's offices are handsomely finished in natural oak, and present a very attractive appearance. The shipping room in the rear is especially large and convenient, and goods can be shipped from this on three different sides. The elevator equipment is electrical, and capable of carrying heavy loads. The building also has its own steam plant. The basement, fifteen feet in height, is finished with a granitoid floor, and has windows on three sides, furnishing abundant natural light. The entire building is equipped with a 25-station system of the Allen-Hussey intercommunicating telephones, so that one can sit at his desk and communicate with any part of the house.

In addition to this building the company also has two large warehouses, and it is claimed the company carries a larger stock of electrical merchandise than any other electrical jobber in the United States.

The growth of this company has certainly been phenomenal. Organized and incorporated under the laws of

Missouri in the winter of 1891, it has grown from a small house doing a purely local business to its present magnitude, and is universally recognized as one of the largest, best-equipped and most popular supply houses in the country.

It would well repay one to go through the extensive stock of this company, composed of a thousand different articles used by the electrical trade, and embracing everything from a toy motor to a dynamo, including iron and copper wires and cables of all kinds, poles, cross-arms, arc and incandescent lamps, transformers, motors and generators of various sizes, telephones, switchboards, line supplies and construction material.

This company are exclusive territorial agents for some of the most prominent and largest manufacturers of electrical goods in the world, among whom might be mentioned:

The Eddy Electric Manufacturing Company, manufacturers of direct-current dynamos and generators; the Warren Manufacturing Company, manufacturers of alternating current apparatus; the John A. Roebling's Sons Company, manufacturers of copper and iron wires and cables of all kinds; the Indiana Rubber and Insulated Wire Company, manufacturers of rubber covered wires and cables; the Adams-Bagnall Electric Company, manufacturers of the celebrated A. B. arc lamp; the Ohio Brass Company, manufacturers of complete railway overhead material; the Emerson Electric Manufacturing Company, manufacturers of the Emerson alternating current desk and ceiling fans; also a large number of others.

This company also controls exclusively certain well-known brands, such as the Monarch incandescent lamp; Hercules friction tape; Wesco dry batteries, etc.

The officers of the company are men of wide experience in the electrical field, and of undoubted ability. The company's business standing and credit is of the highest, and the success it has met with has not only been hard-earned, but well deserved.

They report that their business this year has opened up in a most satisfactory manner, and that at the present time all of their different departments are crowded with orders.

The company has a most complete set of catalogues and descriptive matter, covering, as they do, everything pertaining to the electrical supply business. Their general catalogue is a volume composed of 1,100 pages, and is said to be the largest and most complete catalogue ever issued by any electrical supply house.

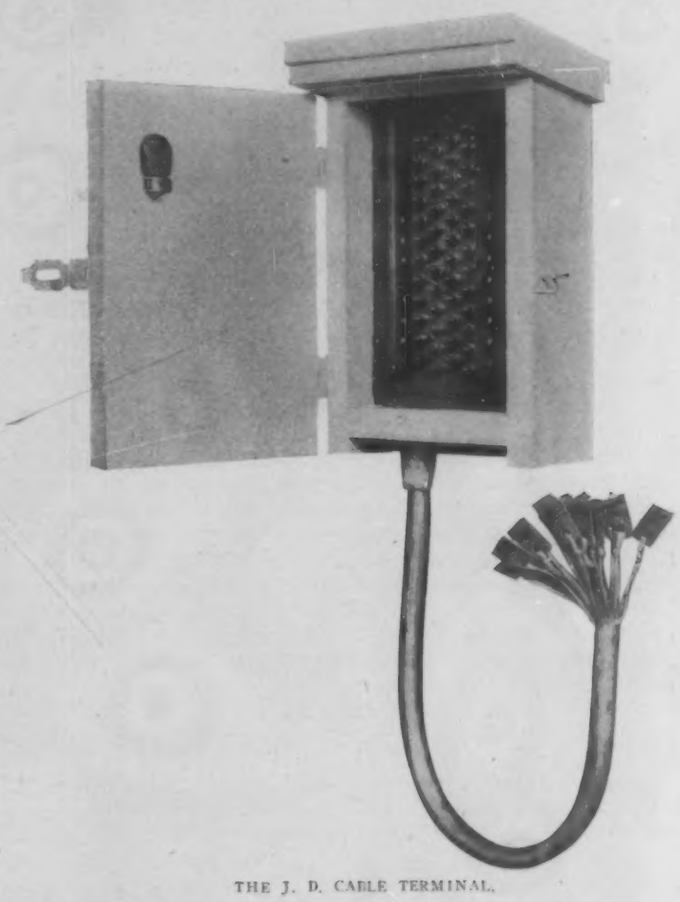
They also issue a catalogue devoted exclusively to electric railway supplies and construction material; another devoted exclusively to telephones and switchboards; another devoted exclusively to lighting supplies, and still another to electric fixtures and supplies.

Any of these catalogues, we understand, will be mailed to the applicant upon request.

JOHNSTON & DEAN, ST. LOUIS.

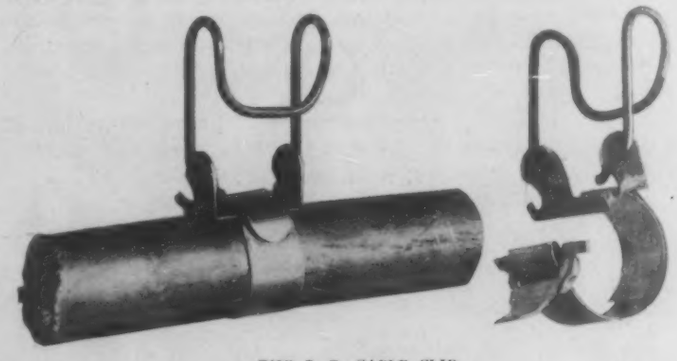
Johnston & Dean, a new firm, of old telephone people, are turning out some very good outside-plant apparatus. Their cable terminal seems to have several features that are at least worthy of mention. The general scheme consists in treating the end of a lead cable in such a way that it is made moisture-proof, and then fanning it out on a well-arranged terminal panel in a cable box. The panel itself is so set in the box, that the cable end is enclosed in a water-tight pocket. The panel is a rock maple board, boiled in an oil that puts its insulating properties up in the megohms. The fuses, and the lightning arrester springs are on the face of the panel and are on one flat surface. This is a good point as reaching around corners is always inconvenient.

In answer to the objection that will be raised to the use of wood, the manufacturers say that boxes they put up eight years ago are still in good order, while nearly every metal cable head installed has needed new gaskets and a boiling out several times since. A box made of three-quarter-inch stuff is one thing, and one made of one and one-quarter-inch dressed lumber, with joints machined and white leaded is quite another. The whole thing is solid and is decidedly not cheap—that is not in appearance—we hear that the prices are attractive. The terminal is made up in three styles—the first having a plain panel, with no protective arrangements; the second, with fuses and bridle wire panels; and the third, with lightning arresters, fuses and bridle panels complete. The standard sizes are 15, 25, 30, 50 and 60 pair terminals with an extra set of posts in each for the spare



THE J. D. CABLE TERMINAL.

pair in the cable. The box is furnished with a section of cable connected that is long enough to reach down the pole to the strand and there splice into the main cable—or the box is shipped unconnected, but accompanied by direections and all the material necessary for connecting, except the cable.



THE J. D. CABLE CLIP.

Another good device is their cable clip, which is shown below. Any one who is familiar with the mechanism of a beer bottle can see the point at a glance. The grip of the strap is altogether independent of the weight of the cable, or the position of the hook. It just snaps in place and stays there. The same clip will fit any ordinary size of cable. Mr. Dean of this company started in as a draftsman in the offices of the Bell Telephone Company in St. Louis. He

worked his way up through the testing and inspection departments and was made general foreman of toll line construction.

Mr. Johnston entered the telephone business in New York City, leaving that company as assistant chief wireman in 1893, to go to the Chicago Telephone Company. He has since been superintendent of construction of the Bell Telephone Company of Missouri, where he had charge of the installation of a large underground conduit and cable system, and superintendent of construction of the Chicago Telephone Company, from which he resigned recently to start in his present business.

THE D. A. KUSEL TELEPHONE AND ELECTRIC MANUFACTURING COMPANY, ST. LOUIS.

Mr. D. A. Kusel, proprietor of the D. A. Kusel Telephone and Electric Manufacturing Company, has been actively engaged in the electrical business for twenty-five years, and is one of the pioneer telephone men of the West, having manufactured telephones and switchboards in 1886, when he established his business in St. Louis, as the D. A. Kusel Manufacturing Company, manufacturer of general electrical apparatus.

Early in 1896 he formed a partnership with Mr. James S. Cuming, under the name of the D. A. Kusel Telephone Manufacturing Company, for the manufacture of telephones and switchboards, exclusively, and operated as such until October, 1897, when the partnership was dissolved and Mr. Kusel continued business under the present name, as the D. A. Kusel Telephone and Electric Manufacturing Company, manufacturers of high-grade telephones and switchboards, and dealers in electrical supplies, now located at 1119 Pine street, St. Louis, Mo., and doing an extensive and steadily increasing business throughout the entire central, western and southern states.

ST. LOUIS ELECTRICAL SUPPLY CO., ST. LOUIS.

The St. Louis Electrical Supply Company is one of the oldest houses in the city, in fact, is the oldest, having been incorporated in 1888. It was principally in the construction business until 1894, when it took up the electrical supply and jobbing business and manufacture of telephones. From this time the business has gradually grown.

The business of the company now covers all the states in the South and Southwest, and it has installed a great many complete telephone exchanges throughout Iowa.

The company has recently moved into a new store, which is a large four-story building, completely equipped for mercantile business, where a complete stock is constantly carried. The company makes a special point of prompt shipments, and filling all its orders with goods that give satisfaction. The officers are Jacob Weinheimer, president, and A. S. Doxsee, secretary.

CULVER LUMBER AND MANUFACTURING COMPANY, KANSAS CITY.

The Culver Lumber and Manufacturing Company succeeded to the business of the Kansas City and Southern Manufacturing Company, which was incorporated in the state of Missouri, November, 1882. The company has been engaged in the manufacture of hardwood lumber and wood specialties ever since, with plants located at Sedgwick, Lawrence County, Arkansas, and at Springfield and Kansas City, Mo. It is the largest manufacturer of insulator pins and brackets west of the Mississippi River. A new cross-arm plant will be installed next year.

The officers of the company are: E. W. Culver, president, Kansas City, Mo.; M. C. Culver, vice-president, Kansas City, Mo.; Edgar W. Culver, treasurer, Kansas City, Mo.; H. A. Culver, general manager, Sedgwick, Ark., and J. E. Culver, secretary, Springfield, Mo.

The name of the company was changed June 1st of this year from Kansas City and Southern Lumber Company to the Culver Lumber and Manufacturing Company.

HODGE-WALSH ELECTRICAL ENGINEERING CO., KANSAS CITY.

The Hodge-Walsh Electrical Engineering Company of Kansas City, Mo., was organized December 2, 1895, and does an electrical manufacturing and jobbing business. R. W. Hodge and J. W. Walsh compose the company.

Mr. Hodge is a graduate of the electrical engineering and classical departments of the State University of Missou. and later gave up a position with the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., to become a member of the above-named firm.

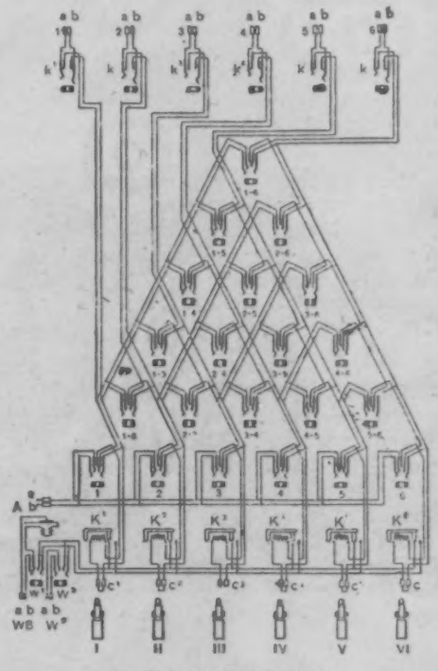
Mr. Walsh is a "T-H" man, having for several years had charge of the winding department of the Thomson-Houston Company at Lynn, Mass.

"The Hodge-Walsh Company," as it is familiarly known, manufacture the "H-W Peerless" telephone instruments, which are very rapidly becoming one of the western favorites. These instruments are designed along the latest and most approved lines and have a number of original and valuable improvements. The company also carries a large stock of telephone construction material and tools from which prompt shipments are made from Kansas City. This is a great convenience to western buyers who in earlier days were compelled to wait weeks for shipments from eastern points.

Although the western country experienced an unusual drouth during the past summer, this company reports the largest volume of business in its existence, the fall trade especially being beyond its expectations.

SMALL TELEPHONE EXCHANGE WITHOUT CORDS.

The principle of an old form of telephone board has been revived, in a modified form, in a cabinet board for small exchanges, described in a recent issue of the *Elektro-*



SWITCHBOARD DIAGRAM.

technischer Anzeiger, and which is now being introduced with the idea of eliminating the troublesome flexible cord. As shown by the accompanying diagram, the jacks are arranged in a triangle, so as to give the necessary number of combinations, the jacks being marked with the two lines which they connect. There are thus fifteen 5-point connect-

ing jacks for a 6-line board, the top one being marked 1—6 and the lower row consisting of five. Below this is the row of six local jacks, which are connected to the operator's set by merely inserting a loose plug, just as in the case of the main jacks. At the top of the board is a row of six drop indicators employed both for calling and clearing signals, and a corresponding row of jacks in case connections are to be made to other boards, and to the right and left of the triangle are jacks to connect in the bell and extension bell if required. The boards are made in sizes for from 3 to 20 lines.

THE CENTRAL TELEPHONE AND ELECTRIC COMPANY, ST. LOUIS.

A history of Independent telephony in the state of Missouri would not be complete without a sketch of the progress shown by the Central Telephone and Electric Company, St. Louis, which concern is one of the largest manufacturers of

PRESIDENT'S OFFICE, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

telephone apparatus in the state. The company was incorporated January, 1899, and succeeded to the business established by its president, Mr. James S. Cuming, in 1895. Starting in a modest way in two rooms of a building where the entire space occupied consisted of about four hundred square feet, it has gradually increased the business so that

GENERAL OFFICE, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

three removals have been necessary within the last six years to secure more space, and the company now occupies the entire building at 909 Market street, with a floor space of 12,000 square feet, and the sales of the company have averaged a greater amount for each month of this year than the total sales of its first year in business.

The company now employs several experienced telephone engineers and its product has been gradually improved to the highest degree as the keynote of their business is—quality first with quick sales and small profits. It manufactures telephone instruments, switchboards, terminal heads

SWITCHBOARD DEPARTMENT, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

and other telephone apparatus, and carries in stock a complete line of everything used with telephones.

We give herewith a few illustrations of different de-

TELEPHONE ASSEMBLING DEPARTMENT, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

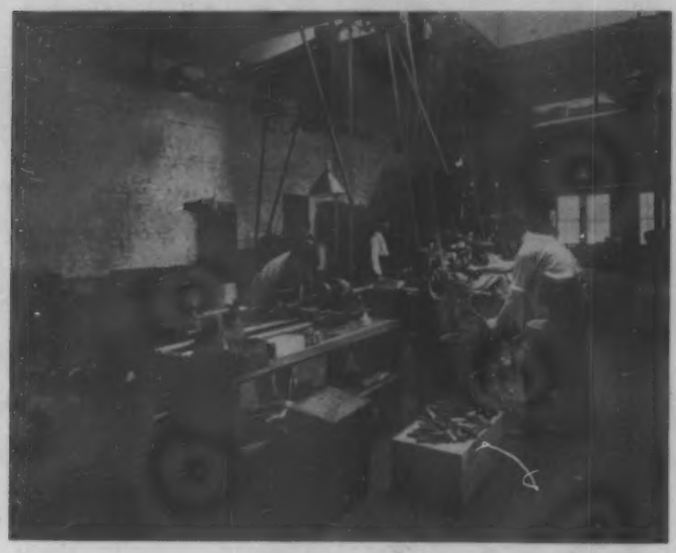
partments of this company's establishment and also the stockholders of the company who are all actively engaged in the business. Mr. James S. Cuming, the president, is manager

CORNER OF SALESROOM, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

of the buying and selling departments. Mr. M. E. Martin, the secretary and treasurer, attends to the financial department. Mr. J. A. Becker, the superintendent of the factory, is an all-around telephone man. This company is also rep-

resented by Mr. H. C. Hoover in Southeastern territory, with headquarters at Atlanta, Ga., and Mr. A. C. Wheat is the company's city salesman.

An exhibit of sample telephone apparatus is now being given by this company at the Texas State Fair, Dallas, Tex.,



SECTION OF MACHINE DEPARTMENT, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

and the Interstate Fair, Atlanta, Ga. The Central Telephone and Electric Company is now supplying apparatus and material to over 100 exchanges in the state of Missouri, and have their complete apparatus in use in twenty-five exchanges in that state alone, in addition to their large trade throughout the South and West. They have also recently furnished complete exchange equipment for Parfirio Diaz,

HEAVY STOCK DEPARTMENT, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

Mexico, and have customers in every state from Maine to California. Catalogues of instruments and supplies will be furnished on application and special figures will be given on specifications.

TELEPHONES IN MINES.

Among the big mine companies there is talk of putting telephones in the coal mines. In the days of doubt which followed the disaster at the Twin shaft, near Pittston, Pa., a few years ago, when 60 lives were lost by the extensive caving in of the mine, the telephone might have been used to advantage in letting the rescuers know the exact location and condition of the imprisoned miners. Of course, it is possible that such a subterranean disaster might render the telephone useless in the mine, but engineers are of the opinion that with reasonable ingenuity and care it is possible to introduce and operate a mine telephone that would not be affected by the caving in of the surface.

Such an improvement would be a great boon to the mine workers, and its general introduction is regarded as a proximate possibility. Having some means of communication with those who are entombed in the depths of the mine would greatly assist in the work of their rescue. It has often happened in the history of mine accidents that the efforts of rescuers were put forward in a direction entirely different from that in which the men were imprisoned, and

WOODWORK AND LIGHT STOCK, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

thus valuable time and energy were wasted. With a system of mine telephoning in operation this would be averted. The plan suggested by those who are friendly to the proposed improvement is to locate telephones at regular intervals along the workings, so that they may be protected as well as possible from accident, and be of easy access to the miners in case of danger. An experienced miner said recently that he thought it entirely feasible to have a telephone in every mine "chamber," and carry it forward as the work progressed. Also that telephones might be placed at regular

CITY RETAIL DEPARTMENT, CENTRAL TELEPHONE AND ELECTRIC COMPANY.

intervals along the gangways, and electric lights, too.

"I would not have the wires running along the roofs, in the first place," he said. "I would run them carefully down the shaft or slope and along the floor of the mine, close at the side, where they would encounter the least resistance. I am positive they could be introduced in that way and made

serviceable. Fancy what a benefit the telephone would have been at the Twin Shaft! It is generally believed that the men who were caught in that accident lived for several days, but it was impossible to locate them. They went in to do repairs and nobody knew what part of the mine they were in when the cave-in occurred. Then, again, I believe the telephone could have rendered great service at Avondale and at Carbondale, Pa., in the fearful disasters which cost so many lives at those places, but it was not discovered in those days."

BRITISH TELEPHONE NEWS.

FROM OUR LONDON CORRESPONDENT.

Following closely on the opening of the Tunbridge Wells exchange, reported last month, comes the inauguration, on a decidedly larger scale, of the municipal service at Glasgow. The telephonic history of Glasgow has been a by no means uneventful one. As far back as 1893 the corporation applied to the postmaster-general for a license, and, after something like a two years' correspondence, the matter was deliberated upon by a House of Commons committee, before whom representatives of Glasgow gave evidence. In 1897 a commission, sitting in Glasgow, went deeply into the subject and agreed that a license should be granted. Nevertheless, it was refused to the corporation, who were informed to this effect in 1898. Chiefly owing to the persistence, however, of the Scotch city, a second Parliamentary committee was appointed soon afterward to inquire whether there was any justification for granting licenses to local authorities. Again did Glasgow give evidence and a reply in the affirmative was the result. Hence, under the provisions of the telegraphs (Telephonic Communication Bill) of 1890, Glasgow received its license, which will expire on December 31, 1913, and at the same time from a competitive point of view, there arose an embittered feeling between themselves and the National Telephone Company, and competition is as keen in "the Second City" of the empire as it is likely to be anywhere—a state of affairs not greatly to be regretted.

Although the service was only publicly inaugurated at the latter end of August, connections have been made for several months. At present nearly 1,500 subscribers are connected to the exchange, and from 20 to 30 new ones are made each day. As, however, there is capacity for 10,000, it will be some time before the limit is reached. The cables are laid underground in the city proper, inclosed in cast-iron pipes having a diameter of three inches. They are 22 S. W. G. and vary from 8 to 312 pairs in each cable. The switchboard at the exchange is a somewhat novel one, as the wires are led to it at either side under wooden planks; thus the whole are visible by merely raising one of the floor boards. As already stated, the switchboard is built to accommodate 10,000 subscribers, but space is available for dealing with double this number. As the switchboard is double sided, operators are, of course, seated on both sides, and although at a pinch it is possible for each operator to control the complete board, their task is normally limited to 40 subscribers each. The area over which a municipal service will ultimately be given embraces some 140 square miles, and at present some £70,000 have been expended out of a total of £120,000 which is authorized by the secretary for Scotland. The tariffs are £5 5s per annum for an unlimited service, or £3 10s and 1 d per call.

As at Glasgow, the Manchester corporation will eventually control an extensive system, but at present the scheme is in its infancy. The scheme at present under consideration is that Manchester, Salford and Eccles shall comprise the local area and that a joint board, to which Manchester shall send ten members, Salford five and Eccles three, shall manage the undertaking. Similarly, in the same proportion, it is proposed that Manchester shall provide two-thirds of the necessary capital and Salford the remaining third, and, further, that when the joint undertaking bears profit exceeding 5 per cent, the excess is to be utilized in reducing the telephone charges. The scheme is still under consideration, however, and the full text of the proposed agreement has not yet been made public.

The annual report of the postmaster-general reviews the present condition of the trunk telephone system of the United Kingdom. On March 31 last there were 76,831 miles of trunk wire laid and working and 7,700 in course of construction. Of the grant made by Parliament for the purpose of trunk telephony, viz., £2,300,000, a total of £1,695,822 has been spent up to date, and of this sum £164,000 are credited to the year ended March 31 last. The postoffices open for trunk working have increased from 299 to 312, and, whereas, nothing further is given in the report to enlighten us as to the present position of the metropolitan telephone service, the public is informed that £140,448 have so far been extracted from the National Telephone Company by way of royalties.

So unanimous has been the feeling generally since the passing of the 1899 act, in favor of municipal telephony, that one is surprised to find a city of the size of Halifax (Yorkshire) (so far as the company's subscribers are concerned, practically) negotiating a similar proposal by 11 votes to 3. The local Chamber of Commerce circularized the National Telephone Company's subscribers, asking the three following questions: (1) Are you in favor of the establishment of a municipal telephone exchange? (2) Do you wish to offer any suggestions? (3) Have you any complaints to make against the present telephone service, either local or trunk? Only about half the circulars were replied to, and of these something like one-half again merely said "yes" to question 1; others agreed, but only on conditions, while still others flatly refused to assent. What few replies were given to No. 2, mostly related to changes in tariff, and one of the chief replies to question 3 was the inefficiency of the trunk service, which is under the control of the postoffice. At a meeting of the Chamber of Commerce soon afterward, it was decided by the majority given above not to encourage the idea of a municipal system. All the same, however, Halifax corporation has decided to apply for a license.

As hinted at in my notes last month, the National Telephone Company has agreed to sell its undertaking in Eastbourne to the local governing body. The terms are for a 21 years' purchase on the basis of last year's net profit.

A little flutter was caused quite recently at Leeds owing to the lady operators at the National Company's exchange going on strike, the cause being an increase of their hours on the part of the local superintendent. The small difficulty was quickly remedied and peace reigns once more.

As I mentioned in a previous issue, the National Company have reduced their tariff to £4 per annum at Tunbridge Wells. An interesting sequel to this is at Hastings, where, with commendable business instinct, the company's subscribers are clamoring for a similar concession. Whether they will succeed until the company's hand is forced remains to be seen. And this does not appear to be the only instance of its kind. At Darwen representations are being made to the National Company for a revision of its present rates, and by way of protest notice has been given that all the telephones in local municipal offices are to be discontinued at the end of the year. Nottingham also is complaining of unfair treatment if their tariffs are not halved, as at Tunbridge Wells.

A body of non-commissioned officers and men of His Majesty's army are to be trained as telephone operators. The war office intends to utilize this body in the fortifications forming part of the home defense.

In addition to the telephone service at Glasgow, mentioned at the beginning of these notes, an entirely independent one has been installed in connection with the extensive system of electric tramways now in service in that city. The General Electric Company, to whom I am indebted for these particulars, have styled it the "traction" telephone, and although no important tramway system here is unequipped with it, Glasgow appears to have the most complete installation of any.

SOME NOTES ON BELL'S TELEPHONE.

BY FRED DELAND.

It is a matter of public record that the invention of Bell's telephone was brought about not through greed for gold or desire for fame, but as an indirect result of an ardent desire to benefit that unfortunate class of individuals known as deaf-mutes. During the nineteenth century the Bell family won enviable reputations in Great Britain, in Europe and in the United States, for their success in correcting inherent defects in speech.

Alexander Bell, the grandfather of the inventor of the telephone, was a teacher of correct speech and of vocal physiology and a professor of elocution in London, England, and the author of a treatise on a rational method for the relief of stammering. His son, Alexander Melville Bell (born in Edinburgh, Scotland, on March 1, 1817), announced in 1842 the formation of a new theory of articulation and vocal expression, an elaboration of which was published in 1849.[1] The preface in this work shows that Mr. Bell did not follow in "the steps of any preceding writer, either as to his theory or his plan of developing it; but he has observed nature for himself, and recorded his observations after his own fashion." From 1843 to 1865, he lectured on elocution in Edinburgh University and in New College; then he moved to London, where he was a professor of vocal physiology and lectured on elocution in University College.

In May, 1867, he brought out his now well-known work on "Visible Speech, or the science of Universal Alphabetics."[2] This system "is not intended to displace established letters, but to be a key to their pronunciation," hence "is equally applicable to all languages."[3] Therein "the shapes of the letters have direct reference to the positions of the organs of speech, and thus can be read at sight into the words of command which the organs have been drilled to obey." Professor A. J. Ellis makes the "simple statement of fact that no system of marking our pronunciations which has hitherto been adopted, has succeeded in marking the extent of natural peculiarities of English speech, to the accuracy possible in Mr. Bell's system." And George Iles states that this "series of symbols would shorten by as much as a year the time needed for the mastery of the English tongue."[4] Though not originally designed to aid the deaf-mutes to talk, yet "to deaf learners these lessons will be of especial value in greatly facilitating the power of speech. However, it is to his son, Alexander Graham Bell, that the credit must be given for having applied the system to deaf-mute instruction."[5] Alexander Melville Bell is also the author of a standard work on stammering, stuttering and other faults of speech.[6] "In 1854, he received from the Royal Society of Arts in Edinburgh, a medal for his discovery of a system of stenography, the characters of which represented the positions of the human organs of speech."[7]

While lecturing in London in 1868, Alexander Melville Bell accepted an invitation to deliver a course of lectures before the Lowell Institute in Boston, Massachusetts. So satisfactory were these lectures that, in 1870, he was again invited to visit the United States and deliver a second course of twelve lectures in Boston. In 1870, owing to the ill-health of his son, Graham Bell, the inventor of the telephone, the father moved his family from London to Brantford, Canada, and became an instructor in Queen's College in Kingston. In 1881, at the request of Graham, the family moved to Washington, District of Columbia, and there established their home.

Alexander Graham Bell, the inventor of Bell's telephone, and usually addressed as Graham Bell, is a grandson of Alexander Bell and a son of Alexander Melville Bell and Eliza Grace Symods Bell, and was born in Edinburgh, Scotland, on March 3, 1847. He graduated at the High School, was a student at the University of Edinburgh, and during the years from 1867 to 1870 he studied at the University in London, England. His health failing as a result of overstudy and close confinement, he relinquished his London work, and accompanied his father to Canada in 1870. Two years later he became a teacher of deaf-mutes in Boston, and subsequently professor of physiology in the University of Boston.

As Graham Bell's education had been planned with a view to his continuing the life-work in which his father and grandfather had achieved such eminent success, it was only natural that he should take a deep and sympathetic interest in the welfare of that sadly afflicted class of individuals known as deaf-mutes, in the instruction of whom his father had attained some prominence. He believed that many deaf mutes were mute only because hearing not, and knowing not the purpose of speech, they refrained from all attempts at talking; for usually no serious defects are found in their vocal organs.

In Graham's boyhood his father made a study of the different shapes assumed by the mouth and the different positions of the vocal organs while talking, and as a result of many experiments invented the system of physiological symbols already referred to that represented the different sounds uttered during a conversation. "He classified vowels by the shape of the mouth,.... and had thirty-six distinct vowel cavities, including nearly all those used for vowel qualities in different languages."[8] The object of this invention was to enable his pupils to attain a correct pronunciation of the foreign languages they studied, and being in a sense pictorial, it graphically illustrated how the pupil should arrange the mouth and vocal organs to produce the desired sounds.

On one occasion an eminent Sanscrit scholar called on Mr. A. Melville Bell, and during his visit made some remarks in Sanscrit. These words were recorded on a slip of paper in the symbolic method. Then the father called his son, Graham, into the room and requested him to repeat or utter the words represented by the written symbols. Graham did so, to the amazement of the teacher of Sanscrit, who declared that he had devoted years in striving to aid his scholars in acquiring so correct a pronunciation. Yet here was a young man correctly pronouncing words he had never heard and never seen.

On another occasion, Mr. Ellis states that: "I dictated slowly but distinctly the sounds which I wished to be written. They consisted of a few words in Latin, pronounced first as at Eton, then as in Italy, and then according to some theoretical notions of how the Latins might have uttered them. Then came some English provincialisms and affected pronounciations, the words, 'How odd' being given in several distinct ways. Suddenly German provincialisms were introduced; then discriminations of sounds often confused. 'Some Arabic, some Cockney English, with an introduced Arabic gutteral, some mispronounced Spanish, and a variety of shades of vowels and dipthongs. The result was perfectly satisfactory—that is, Mr. Bell wrote down my queer and purposely exaggerated pronounciations and mispronounciations, and delicate distinctions, in such a manner that his sons, not having heard them, so uttered them as to surprise me by the extremely correct echo of my own voice. Accent, tone, drawl, brevity, indistinctness were all reproduced with surprising accuracy. Being on the watch, I could, as it were, trace the alphabet in the lips of the reader. I think, then, that Mr. Bell is justified in the somewhat bold title that he has assumed for his mode of writing—'Visible Speech.'"[9]

On September 6, 1866, a distinguished Bohemian linguist, Cenek Sercl, wrote: "At the request of Mr. Bell, I dictated to him many of the most difficult words of the Bohemian language, which were afterwards read by his son, who having been absent at the time of dictation, did not hear us pronounce them, but nevertheless pronounced them in a very satisfactory manner, and extremely intelligibly."

Graham's success in reading these symbols led him to reason that as it was possible for him to speak an unknown language solely by the aid of written symbols, possibly he could utilize this same method in teaching deaf-mutes to

talk. So when he went to London to begin his three-year course of studies at the University, he formed a class of a few deaf-mute little children, and after months of earnest, patient effort he had the satisfaction of hearing some of these children utter a few simple words. This remarkable success encouraged him to improve and expand his system so "that the symbols for any sound or series of sounds, capable of production by the human voice, can be written, and when read be exactly reproduced, even though the person reading it has never heard the sounds before."[3]

Later on in life Graham Bell urgently recommended that the schools "teach deaf children to think in English by using English in their presence in a clearly visible form. Let us teach them to speak by giving them instruction in the use of their vocal organs. Let us teach them the use of the eye as a substitute for the ear in understanding the utterances of their friends—for the great barrier to the social relations of the deaf and the hearing is the sign language in which the former think. This effectually prevents them from enjoying general intercourse. The remedy is to be found in adopting the principle of teaching the deaf, who have usually no other organic defect, first to speak, and second to read from the lips." This is Mr. Bell's great panacea. He would abrogate gesture language. He would substitute the language of the country. "This removes the barrier between the deaf and the hearing. This renders general sociability possible. At present special sociability alone can exist."[4]

Hubert says that "Graham Bell first carried to great perfection in this country the art of enabling the deaf and dumb to enunciate intelligible words and sounds that they themselves, have never heard. The vast fortune he gained from the telephone has enabled him to continue costly experiments in aiding deaf and dumb people."[1]

General Greely states, "as one of the many examples of the possibility of this system of Bell's visible speech, may be instanced a lady, an acquaintance of the writer, who has acquired such facility of speech and lip-reading, such wealth of knowledge and aptness of expression, as make her most attractive to all who are favored with her society."[2]

In a letter written to Mr. George Iles, by Professor Alexander Melville Bell, from his residence in Washington, D. C., under date of November 14, 1899, we learn that "in the boyhood of my three sons I took them to see the speaking-machine constructed by Herr Faber, and we were all greatly interested in it professionally. To test their theoretical knowledge, and their mechanical ingenuity, I offered a prize to the one who should produce the best results in imitation of speech by mechanical means. All, of course, set to work, but nothing of startling novelty was devised. The scheme of my second son, A. G. Bell, was, however, the best. This contest—as well as the whole course of the boys' education—directed their minds to the subject, until the sole survivor of the lads came to the conclusion that imitative mechanism might be dispensed with, and merely the *vibrations* of speech be transmitted to an electric wire. This was entirely his own idea. I can claim nothing in the telephone but the impulse which led to the invention."[1]

Now, the evolution of all these improvements in Bell's method of speech are interrelated to the invention of the telephone, and, like that invention, are largely due to the helpful suggestions and assistance, received from the many friends Graham Bell made while teaching in Boston. And it all came about in the following manner.

When his health broke down through overstudy and incessant labor in his chosen field, Graham Bell was forced to give up all study and all work in London, and so decided to accompany his father who was moving to Canada. Some months later the father was invited to deliver a lecture in Boston on the value of his method of symbolic or visible speech in the teaching of languages. At the close of this meeting a teacher of deaf-mutes discussed the possible value of this or some similar system in his profession, and this led Mr. Bell to explain the success his son had met with in teaching deaf-mutes in London. In turn this led to Graham Bell's receiving an invitation from the Board of Education of the City of Boston, requesting him to conduct a series of experiments in Boston's school for the deaf and dumb with his improved system of physiological symbols.

Now it appears that in the year 1869 an investigation undertaken by the municipality resulted in finding more than fifty deaf-mute children in Boston, only twenty-two of whom received instruction in any form, and that at least twenty-eight children were kept at home with no one in a position or competent to render any aid in their need and longing for an education. So a school for deaf-mutes was opened in November, 1869, and nine pupils admitted; and in January, 1870, the pupils were transferred to a room in a more suitable building on Pemberton Avenue. This was the beginning of the well-known Horace Mann School, and to this school Graham Bell came in 1871.

On reporting for duty in his new field of labor, the teachers in this school told Graham Bell "that they thought that deaf-mutes could be taught to talk. Of course I believed this, for was I not the one who knew all about doing it; but they said, and I, in my superior knowledge of everything, would not believe it, that they could be taught to read the lips of the person speaking," says Mr. Bell.[4] "My extreme credulity led me to try to devise other means by which deaf-mutes would read speech, and though they resulted in utter failure, the result of my failure in this direction was the telephone." For he believed "that the vibrations of the vocal chords reach the ear with the same constancy through the tissues as by the mouth and the ambient air." And that "persons absolutely deaf to external sounds still hear their own voice."

As Graham Bell freely admits, this proposed method of speech reading which time has proved to be invaluable appeared to him to be impracticable. Nevertheless it set him to work to devise means and methods for optically exhibiting to deaf-mutes the vocal vibrations of the spoken word and the mechanism of speech, in the hope that something might be invented that would prove a valuable auxiliary in the propsed method of teaching pupils to read speech as rapidly as it fell from the lips of a closely observed careful speaker.

Clerk-Maxwell has shown how "the inventor of the telephone was prepared, by early training in the practical analysis of the elements of speech, to associate whatever scientific knowledge he might afterwards acquire with those elementary sensations and actions, which each of us must learn from himself, because they lie too deep within us to be described to others. This training was put to a very severe test when, at the request of the Boston Board of Education, Professor Graham Bell conducted a series of experiments with his father's system in the Boston School for the Deaf and Dumb. I cannot conceive of a nobler application of a scientific analysis of speech than that by which it enables those to whom all sound is

'expunged and rased
And wisdom at one entrance quite shut out'

not only to speak themselves, but to read by sight what other people are saying. The successful result of the experiment at Boston is not only the most valuable testimonial to the father's system of visible speech, but an honor which the inventor of the telephone may well consider is the highest he has attained."[1]

In detailing the many steps that led to the marvelous invention of Bell's telephone, it is necessary to go back to his college days in Edinburgh, where he assisted his father in many experiments "to discover the correct mechanism of English and foreign elements of speech," as well as the musical relations of the vowel sounds, and to determine the natural pitch of each vowel. They knew that when vowel sounds are whispered, each vowel seems to possess a particular pitch of its own; and that by whispering certain vowel sounds in rapid succession a resemblance to a musical scale is perceptible to the experienced observer. In some experi-

ments made to determine the exact pitch of each vowel, Graham Bell vibrated a tuning fork in front of or as close as possible to the opening of the air-chamber which lies behind the upper teeth, when sounding the vowel, while his father observed and noted the position of the vocal organs, the shape of the mouth, and the pitch of the vowel. But in uttering certain vowel sounds the use of the tuning fork did not permit of complete observation. So Graham Bell was in the habit of bringing out these proper tones by placing his mouth in the required positions and then tapping against a finger placed just in front of the upper teeth, for the higher resonance, and placed against the neck, just above the larynx, for the lower. Ellis tells[8] how Graham Bell "obligingly performed the experiment several times privately before me. And the successive alternations and differences in their direction were striking. The tone was dull and like a wooden harmonica. Considerable dexterity seemed necessary to produce the effect, and I could not succeed in doing it. He carried out the experiment much further than is suggested in the text, embracing the whole nine positions of the tongue in his father's vowel scheme, and obtaining a double resonance in each case."

While engaged in this work Graham Bell noticed that in sounding certain vowels certain tuning forks seemed more responsive than others, repeating, as it were, the very vowels he uttered. This led to further observations that proved so interesting to father and son that the results were communicated by letter to Mr. Alexander J. Ellis, of London, the president of the Philological Society. Mr. Ellis who was then engaged on his admirable translation of Helmholtz's great work on the "Sensations of Tone," replied that experiments similar to these had already been observed and studied by Helmholtz, and in a much more perfect manner. Moreover, that Helmholtz had not only analyzed the vowel sounds into their musical elements, but had actually performed the synthesis of them, producing, artificially, certain of the vowel sounds through combining musical tones by causing a harmonic series of tuning forks of different pitch to vibrate simultaneously by means of an electric current passing through a series of electromagnets between the poles of which these specially prepared tuning forks were placed; while above each fork a resonator was arranged to reinforce the sound.

But Mr. Ellis became so interested in some of the results attained by Graham Bell, that he invited him to come to London and discuss the subject. On his arrival Mr. Ellis kindly translated some of the writings and explained the methods and means employed by Helmholtz in some of his experiments. So fascinating did this work appear to Bell that he quickly secured a copy of Helmholtz, had the necessary sections translated, and then endeavored to reproduce many of these experiments. While reflecting on the possibilities of the production of sound by electrical means, the thought occurred to Graham Bell that the principle of vibrating a tuning fork by the intermittent attraction of an electromagnet might be applied to the electrical reproduction of musical notes at points distant from the sender. In turn, this thought led to a thorough study of electricity, and especially to the various systems of telegraphy, and he became greatly interested in the simplicity of the Morse method of message reading by sound.

Thus it naturally came about that during the period from 1866 to 1870, all the time that Graham Bell could spare from his studies and his deaf-mute instructions was devoted to devising an instrument that would make and break a battery circuit with extreme rapidity, to take the place of the transmitting tuning fork used in Helmholtz's researches. He believed that in place of having the tuning forks produce tones of uniform intensity responsive to the action of an intermittent electric current from a larger fork connected to a battery, these tones being increased or decreased in loudness by an external reinforcement in the form of resonators of different sizes, the same results could be obtained in a more perfect manner by causing the tuning forks themselves to vibrate with different degrees of amplitude. So he devised a telephone in the form of a harp of steel rods attached to the poles of a permanent magnet with an electromagnet placed between the tines of the forks."

While these experiments were fruitless in immediate practical results possessing commercial value, they did enrich and broaden Bell's grasp of the subject, and led him to reason that if Helmholtz transmitted vowel sounds and even musical notes over a wire, why not transmit consonants? And if consonants, why not speech? So there ran through his mind the possibility of the transmission of speech by electricity. It was "like an undercurrent of thought that he could hardly formulate in definite expression; but it gradually took clearer shape, and before 1870, to friends in England, Graham Bell avowed his belief that we should 'one day speak by telegraph.'"

In one of the best of these experimental harmonic devices a steel rod was employed as a transmitting instrument and kept in continuous vibration by the action of an electromagnet controlled by a local battery. In vibrating, this reed touched alternately two fixed points thus closing alternately a local and a main circuit, and the two instruments were connected by a line wire attached to a main battery. When the normal rate of vibration of the reed placed in front of the receiving magnet was the same as the vibrating reed of the transmitting instrument, the former would emit a musical tone of a pitch similar to that produced by the reed of the transmitting instrument; but if normally of a different pitch it would remain silent. In other words, from the combined sounds each tuning fork "would pick out and respond only to tones emanating from a fork in unison with it." "If two tuned reeds be sounded together, then the electrical impulse from each, moving at different rates at the same moment, will traverse the wire simultaneously, and these will be disentangled by each of two receiving reeds vibrating responsively under the impulse of the transmitting reed in unison with it. In this manner two messages are sent simultaneously over a single wire, and are received by sound separately from different reeds."[9]

And now to return to Graham Bell's connection with the Horace Mann School, and to the interesting experiments that led to a final solution of this all-absorbing problem that gave his mind no rest. If Helmholtz transmittted vowels over a wire, why not transmit consonants? And if consonants and vowels are transmitted, why not transmit articulate speech?

Through his acceptance of the invitation of the Board of Education of the City of Boston to introduce his method of teaching the deaf and dumb, and his ceaseless efforts to devise methods and means for portraying speech to the end that the mental development of deaf-mutes might be enriched and the acquisition of knowledge made comparatively easy through possessing the ability to comprehend speech and thus to converse freely, Graham Bell made the acquaintance of a number of congenial, resourceful and generously helpful workers in various professions in and around Boston, who freely aided him with services and suggestions without thought of reward of return. This friendship began in October, 1872.

The scientific apparatus at the Institute of Technology in Boston was freely placed at Graham Bell's disposal for carrying on his experiments to aid the deaf-mutes. In 1855 Leon Scott invented an ingenious sound-recording instrument which he called a phonautograph. An improved type of this recorder, devised by one of the Technology students, a Mr. Maurey, was used by Graham Bell. This phonautograph had a large funnel-shaped trumpet closed at the small end by a very thin animal membrane tightly stretched across it. To this membrane a wisp of hay, or piece of soft wood, was glued. When properly operated by the associated mechanism, a plate of smoked glass would pass immediately beneath or in front of the wisp of hay, and the movements of the latter be traced on the sooty surface of the glass. The wavering lines so traced served

not only to demonstrate each and every vibration of the membrane, but to make known the form of the special corresponding curve of any word or song spoken or sung into the open end of the receiver or trumpet. Maurey's improvement included a wooden stylus about twelve inches in length that enabled him to secure enlarged tracings upon an enlarged plane of smoked glass. With the aid of Maurey's instrument, Graham Bell "succeeded in producing very beautiful tracings of the vibrations of the air for vowel sounds."

Now Graham Bell had made a careful study of the anatomy of that perfect piece of mechanism we call the human ear, and during these experiments was so impressed by the similarity of action when the wooden stylus was vibrated by the membrane of the phonautograph, and when the ossiculæ of the human ear were moved by the tympanic membrane, that he decided to ascertain what results could be obtained from a modified form of phonautograph modeled closely upon the mechanism of the human ear. He knew that the peculiar curve of the membrane or drum of the ear, and the difference in tension of its several parts, enabled it to readily respond to the impact of a wide range of musical tones, extending in the normal ear from a tone of thirty-two vibrations to one of over forty thousand vibrations per second.

So, with this purpose in view, Graham Bell consulted "a distinguished aurist in Boston, Dr. Clarence J. Blake, who suggested the use of the human ear itself as a phonautograph, instead of making an artificial imitation of it. The idea was novel and struck me accordingly, and I requested my friend to prepare a specimen for me, which he did," says Graham Bell. And Dr. Blake used this specimen to good advantage in studying the membrane tympani. For he writes that "in conducting the experiments with this apparatus, I am greatly indebted to the advice and co-operation of Prof. Graham Bell of this city, who has also availed himself of this means in his investigations of the manner in which articulate sounds are produced."[6]

This ear was suitably mounted on a stand, the necessary mechanism added to move a plate of glass slowly over a line parallel with its inner surface, and a cylinder or receiver so placed as to convey the sound directly into the ear. From the ear the stapes was removed and a single selected fiber of split wheat straw from which the inner cortical substance had been removed, fastened to the descending process of the malleus or incus by means of glue or pitch in a line with the long axis of the process and extending downward from half an inch to an inch and resting very lightly on a plate of smoked glass clamped on a bed arranged to move by a cord and weight mechanism as rapidly as desired. Upon moistening the membrana-tympani and the ossiculæ with a mixture of glycerine and water, the necessary mobility of the parts was obtained. Then, as Bell sent the tones of his voice into the cylinder placed in front of the ear, the waves of sound entering the external auditory canal impinged upon the outer surface of the drum of the delicate membrane of the tympanum, causing it to vibrate in unison with the undulations in the tones of the voice. And in perfect unison with these vibrations of the drum, the bones of the ear were set in motion, causing the straw stylus to write upon the surface of the smoked glass tracings of sound waves more nearly perfect than any Bell had ever seen, some low and heavy, others light and long, depending on the character of the tones he spoke or sang into the tube or cylinder leading to the orifice of the ear. For each sound produces its distinctive curve. Various tone colors possess various curves, and each individual tone has its corresponding compound curve. Each vowel sound has a corresponding curve, but the form of the curve changes with the pitch of the vowel.

Now this beautiful experiment, like many others that Graham Bell had undertaken, proved a failure in the sense that certain desired results were never attained therefrom. But in a far wider sense this experiment was of inestimable benefit and thus was a grand success. For while he was engaged in observing how perfectly the small, thin membrane sympathetically responded to every change in his voice, a thought came and led directly on to the invention of Bell's telephone. So impressed was Graham Bell with the ease with which that little delicate piece of skin known as the tympanum of the ear, moved bones massive in size when compared with its own measurements, that in his own words: "It occurred to me that if a membrane as thin as tissue paper could control the vibration of bones that were, compared to it, of immense size and weight, why should not a larger and thicker membrane be able to vibrate a piece of iron in front of an electro-magnet? And if so, then the complication of steel rods employed in my harp or musical telephone could be replaced by a simple piece of iron attached to a membrane placed at each end of the circuit. Suppose I construct two telephones fashioned after the mechanism of this ear, placing one at a distance and connect it to the other by a telegraph wire having a battery connection, will the sound of my voice be transmitted by the electric current and cause the diaphragm in the other device to vibrate in unison?"

So earnestly did Graham Bell labor to crystallize this thought into practical form that in October, 1874, he described to Dr. Blake a simple form of apparatus consisting principally of a magnet and a parchment diaphragm having a vibrating iron spring coiled on and glued thereto. Each movement of the diaphragm would generate a current of electricity, and he hoped that the undulations of the current so generated would rise and fall in unison with the varying force with which the tones of the voice impinged upon the diaphragm. In other words that he could "cause the intensity of an electrical current to vary in the same proportion as the density of the air varied in the production of sound." Yet he doubted whether "currents generated by such slight movements of a thin armature would be sufficiently strong to produce audible effects at the receiving station." After numerous experiments carried out during the nine months following, his doubts were removed by ample proof that the tones of the voice impinging upon a thin diaphragm would produce currents of requisite strength. This success came to him on June 2, 1875, and "at once removed the last supposed difficulty from his mind, and the electrical-speaking telephone became to him a completed discovery and a fixed fact."[7] Again changing the form of the iron sheet glued to the diaphragm and employing thinner and more sensitive diaphragms, Graham Bell succeeded in transmitting faint sounds on July 1, 1875. Commenting on the progress attained at this period, George B. Prescott wrote: "So far as the actual transmission of speech was concerned, the results he (Bell) then obtained were trivial. But they were significant. For the first time, so far as was known, the voice of the speaker, by means of a true kind of a current, had produced a sound, and these experiments demonstrated the practicability of transmitting articulate speech by instruments having the same mode of operation and principle as these stretched membrane instruments; it was only necessary to make further experiments to ascertain the best arrangement of the parts."[7]

That Graham Bell was clearly realizing the underlying principles involved in a satisfactory solution of the problem of the electric transmission of speech is shown in these step-by-step experiments, and in the improved character of the different forms of experimental apparatus, which, as he modestly stated "have been multitudinous." On August 14, 1875, he described his invention as "involving a great principle, consisting in the creation and employment of electrical undulations similar in form to sound waves, and he insisted that whatever sounds could be transmitted by the air, including 'spoken utterances,' could be transmitted by these undulations, and he believed that his apparatus was sufficient to accomplish it."

During these three years of Graham Bell's professional services at the School for the Deaf and Dumb, he was in constant communication with many warm friends he had won in this new field. In addressing the Society of Tele-

graph Engineers, in London, on October 31, 1877, Graham Bell said, "and here I wish to express my indebtedness to several scientific friends in America for their co-operation and assistance. I would specially mention Professor Peirce and Professor Blake, of Brown University, Dr. Channing, Mr. Clarke, and Mr. Jones. In Providence, R. I., these gentlemen have been carrying on together experiments seeking to perfect the form of apparatus required, and I am happy to record the fact that they communicated to me each new discovery as it was made, and every new step in their investigations. It was, of course, almost inevitable that these gentlemen should retrace much of the ground that had been gone over by me, and so it has happened that many of their discoveries had been anticipated by my own researches; still, the very honorable way in which they from time to time placed before me the results of their discoveries entitles them to my warmest thanks and to my highest esteem. Professor Peirce was the first to demonstrate the extreme smallness of the magnets which might be employed. . . . . I must also express my obligations to my friend and associate, Mr. Thomas A. Watson of Salem, Mass., who has for two years past given me his personal assistance in carrying on my researches."[4]

In his able address to the members of the American Association for the Advancement of Science, Graham Bell again showed how gratefully he remembered the invaluable assistance so generously and disinterestedly given in the days when success seemed as distant as ever. While explaining the experiment carried out by Mr. Sumner Tainter and himself that demonstrated that "without the use of a conducting wire as in electric telephony, we can speak from station to station wherever, we can project a beam of light," Mr. Bell said:[5] "I am extremely glad that I have had the opportunity of making the first publication of these researches before a scientific society, for it is from scientific men that my work of the last six years has received its earliest and kindest recognition. I gratefully remember the encouragement which I received from the late Professor Henry, at a time when the speaking telephone existed only in theory. Indeed, it is greatly due to the stimulus of his appreciation that the telephone became an accomplished fact. I cannot state too highly, also, the advantage I derived in preliminary experiments on sound vibrations in this building from Professor Cross, and near here from my valued friend Dr. Clarence J. Blake. When the public were incredulous of the possibility of electrical speech, the American Academy of Arts and Sciences, the Philosophical Society of Washington, and the Essex Institute of Salem, recognized the reality of the results and honored me by their congratulations. The public interest, I think, was first awakened by the judgment of the very eminent scientific men before whom the telephone was exhibited in Philadelphia, and by the address of Sir William Thomson before the British Association for the Advancement of Science. At a later period when every practical telegrapher considered the telephone as a mere toy, several scientific gentlemen, Prof. John Peirce, Prof. Eli W. Blake, Dr. Channing, Mr. Clark, and Mr. Jones of Rhode Island, devoted themselves to a series of experiments for the purpose of assisting me in making the telephone of practical utility, and they communicated to me, from time to time, the results of their experiments with a kindness and generosity I can never forget. It is not only pleasant to remember these things and to speak of them, but it is a duty to repeat them, as they give a practical refutation to the often repeated stories of the blindness of scientific men to unaccredited novelties, and of their jealousy of unknown inventors who dare to enter the charmed circle of science."[6]

In April, 1875, Graham Bell was granted letters-patent for a method of, and apparatus for, a system of multiple telegraphy.

On January 20, 1876, he prepared the specifications covering "the method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth." The application was formally filed on February 14, 1876, and on March 7, 1876, letters-patent No. 174,465 were granted to Alexander Graham Bell.

This was the broad and fundamental telephone patent that formed the storm-center for the most expensive patent litigation known. Yet that brief claim weathered every storm, was sustained in all the higher courts, and will ever stand as a monument to the integrity and unimpeachibility of the highest courts in our land.

About a month later, in April, 1876, the editor of the Daily Expositor of Brantford, Ontario, Canada, wrote: "Our readers will remember that last summer (1875) Professor A. G. Bell gave, at the office of the Dominion Telegraph Company in Brantford, an exposition of his telegraph discoveries; since then considerable advance has been made in the improvement of the apparatus, and some of the results now obtained are very striking. Thus, from an electromagnet at one end of a single wire are heard issuing the sounds of the human voice-tones and words which were spoken or sung before a membrane connected with an electromagnet at the other end of the wire. To carry the sound of the human voice over the mystic wire is an accomplishment never before scarcely dreamed of! Professor Bell's labors with visible speech, and the success which has accompanied his efforts to make a practical use of it with the deaf mutes in Boston, have already given him an enviable reputation, although his father, Professor A. M. Bell of Tutelah Heights, may be credited with the discovery of it."

And referring to this time when "I put up my first telephone," Graham Bell has written: "At that time I was visiting at my father's house in Brantford—a small city in Ontario, Canada. We obtained the permission of the Canadian government to use a telegraph line four miles long that extended from Brantford to a neighboring village. We put up our apparatus in a friend's house, kindly loaned for the purpose, and as it was over half a mile from the telegraph line we were obliged to lengthen the wire. No additional telegraph wire was available, so what do you think we used? You would never guess. We could find nothing in the hardware stores but stovepipe wire, and we had to buy up all the stovepipe wire in Brantford to make our line long enough. We did not trouble to put up posts, but tacked the wire to the fence. The communication that took place over this first telephone wire was not a conversation, but a monologue, as we had the transmitter only at one end and the receiver at the other. In this way the first message was sent over the telephone, and I have been told that Brantford calls itself the 'Telephone City' ever since. This was in 1875."[7]

Graham Bell's "first public lecture on the telephone was delivered before the Society of Arts, in Boston, on May 25, 1876," two months prior to his explanation of method and apparatus to the eminent jurors at the Centennial. Yet for six months after the fundamental telephone patent had been granted no one appeared to consider Bell's patent, his methods or his apparatus of special value, or possessing unusual interest other than as a "scientific toy," until the most eminent among English scientists, after carefully studying method and system and device, told the world that "Bell's toy" was "the most marvelous invention of the century." And then the scientific world awoke to the fact that, as Sir William Thomson declares, "this, the most recent application of the electric current to the reproduction of the human voice, appears to surpass all other modern discoveries, great as they have been." And this is the manner in which these invaluable scientific indorsements came to "Bell's toy."

At the opening of the Centennial, Graham Bell's telephone was deemed of so little importance that it was placed in a side room in one of the galleries, in the section allotted to the Massachusetts educational exhibits. The transmitter

shown consisted of an electromagnet horizontally mounted, in front of the free end of which a thin diaphragm of goldbeater's skin was stretched. On the center of this diaphragm directly facing the free end of the magnet core a piece of soft iron was cemented. The receiver consisted of a soft iron tube inclosing a single-coil electromagnet. "The magnetic circuit was nearly but not quite closed by a disk screwed to the tube at one side and depending on its own elasticity for maintaining vibrations under varying pull of the magnet." Naturally "vocal communication was only established in one direction."

About June 20, 1876, Mr. Bell was invited to Philadelphia to personally explain his invention to the jurors. On June 25, 1876, after the greater part of the day had been given to the inspection of other electrical apparatus, so that insufficient time remained for satisfactory trial of Prof. Bell's invention, the judges and the Emperor and Empress of Brazil proceeded to the Massachusetts gallery, and Prof. Bell explained briefly his inventions, and some experiments were made with the speaking telephone, enough to excite the curiosity of those present in the highest degree. "What yesterday I should have declared impossible, I have to-day realized. Before long friends will whisper their secrets over the electric wire," said Sir William Thomson. "The results were so at variance with the views hitherto received that it was determined by my distinguished colleague, Sir William Thomson, to make other experiments, in which I took part," says Prof. James C. Watson." "These experiments were made two or three days later in the building known as the Judges' Pavilion, in the evening, after the visitors had left the grounds. Prof. Bell had returned to Boston and was not present at this trial of his apparatus. It was brought over to the Judges' Pavilion, at my request, by Mr. Hubbard, one of the officers in charge of the Massachusetts exhibit, and the experiments were made by Sir William Thomson and myself. Every precaution was taken to make an impartial test. I was at the transmitting instrument, which was placed out of doors at a distant part of the building, and Sir William Thomson was at the receiving instrument in a distant room in the building. After some experiments to find the pitch of voice which would suit the vibrating membrane then used, I received word by messenger from Sir William that he could then hear distinctly, and accordingly the pitch of voice then used was maintained in the subsequent trials. I held in my hand a copy of the New York Daily Tribune and began to read to him items from its news summary, and soon the messenger came to tell me that the messages were heard distinctly at the other end. The longest message which I sent was the following from that paper: 'The Americans of London have made arrangements to celebrate the coming Fourth of July,' and the messenger brought me back from Sir William Thomson the exact repetition of the message. Thereupon we exchanged places, and I could not only hear distinctly the utterances of my colleague but I could even distinguish the ictus of his voice. The results convinced both of us that Prof. Bell had made a wonderful discovery and that its complete development would follow in the near future." A day or two later Prof. Watson received a letter "from Mr. Bell, dated at Boston, Wednesday, June 28, 1876, in which he gives diagrams showing how we might arrange the apparatus to transmit articulate speech, as he believed, from Boston to Philadelphia, and proposing experiments to that end if the judges should so desire."

Later the judges prepared two official reports on Graham Bell's invention. The first one, prepared and signed by Sir William Thomson and other jurors, opened with the statement "That Mr. Alexander Graham Bell exhibits an apparatus by which he has achieved a result of transcendent scientific interest—a transmission of spoken words by electric currents through a telegraph wire. I heard distinctly several sentences. I need scarcely say I was astonished and delighted. So were others, including some judges of our group, who witnessed the experiments and verified with their own ears the electric transmission of speech. This, perhaps the greatest marvel hitherto achieved by the electric telegraph, has been obtained by appliances of quite a homespun and rudimentary character. With somewhat more advanced plans and more powerful apparatus we may confidently expect that Mr. Bell will give us the means of making the voice and spoken words audible through the electric wire to an ear hundreds of miles distant."

The second official report of the Centennial jurors was prepared by Joseph Henry, secretary of the Smithsonian Institution, and reads: "The telephone of Mr. Bell aims at a still more remarkable result—that of transmitting audible speech through long telegraph lines. In the improved instrument the result is produced with striking effect, without the employment of an electrical current other than that produced by the mechanical action of the impulse of the breath as it issues from the lungs in producing articulate sounds. It is evident that in this arrangement any disturbance of the magnetism of one of the permanent magnets, increasing or diminishing it, will induce electrical currents, which traversing the long wire will produce a similar disturbance of the magnetism of the arrangement at the other end of the wire. Audible speech has, in this way, been transmitted a distance of three hundred miles, intelligible to those who have become accustomed to the peculiarities of certain of the sounds. This telephone was exhibited in operation at the Centennial Exhibition, and was considered by the judges the greatest marvel hitherto achieved by the telegraph."

The encouragement he received from the scientists who composed the board of judges at the Centennial led Graham Bell to make further experiments, and "after Sir William Thomson left America I determined to vary every point of the telephone and observe the effect. In that manner I hoped to discover the capacity and power of each portion of the telephone, and so construct one which would produce perfect results. I found that on enlarging the circular disc of iron attached to the membrane the sounds emitted from the other end were more distinct and lucid."

Within three months from that momentous meeting in the Centennial building, on that quiet Sabbath in June, the members of the British Association for the Advancement of Science, assembled in the city of Glasgow, Scotland, for the summer meeting, and there heard their president publicly state that Bell's rudely constructed telephones were the most marvelous of all the many wonderful exhibits he had seen while in America. This president of the British Association was Sir William Thomson (now Lord Kelvin), to whom Graham Bell had presented a magneto receiver having "a soft iron diaphragm." And in delivering his presidential address he told the members how wonderful it all seemed when he first heard the words spoken at the other end of the line coming over the wires. "All this my own ears heard, spoken to me with unmistakable distinctness by the thin circular disk armature of just such another little electromagnet as this which I hold in my hand. The words were shouted with a clear, loud voice by my colleague-judge, Prof. Watson, at the far end of the telegraph wire, holding his mouth close to a stretched membrane such as you see before you here, carrying a little piece of soft iron which was thus made to perform in the neighborhood of an electromagnet in cirsuit with the line motions proportional to the sonorific motions of the air. This, the greatest by far of all marvels of the electric telegraph, is due to a young countryman of our own, Mr. Graham Bell of Edinburgh, Montreal and Boston, now becoming a naturalized citizen of the United States. Who can but admire the hardihood of the invention which devised such a very slight means to realize the mathematical conception that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of this current must vary continuously and as nearly as may be in simple proportion to the velocity of a particle of air engaged in constituting the sound?"

It was this generous and noble indorsement of Bell's telephone by the president of the British Association, coupled with the same scientist's favorable report while serving as a juror at the Centennial, that opened the eyes of scientific workers in every country.

And following Sir William Thomson's ardent advocacy of the great value to the scientific world of Bell's invention, learned men in every land began to investigate its merits and to approve of its technical value and to suggest improvements. But in its simplicity Bell's telephone appeared to be a disappointment to everyone until continued practical use demonstrated how completely it merited all the praise that was showered upon it as an actual speech-transmitting device. Even the lamented Clerk-Maxwell pictured "some triumph of construction skill, something as far surpassing Sir William Thomson's siphon-recorder in delicacy and intricacy as that is beyond a common bell-pull. When at last this little telephone appeared, consisting, as it does, of parts, every one of which is familiar to us, and capable of being put together by an amateur, the disappointment arising from its humble appearance was only partially relieved on finding that it was really able to talk.'"

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Assessments on the telephone, street railway and electric light companies of Toronto, Canada, have increased this year by $2,475,069.

RURAL TELEPHONES.

The telephone is transforming the social and business life of many rural communities of the United States. In no other branch of activity is the spirit of expansion more manifest. Country folks like the instrument because it brings them into novel relationship with the rest of the world. City people who make periodical visits into the country are sorry to see the innovation, because it takes away something of the charm of isolation when they have grown weary of the rush and fever of urban life.

In some country communities the dream of Edward Bellamy is being partially realized. People sit in their homes, miles from any church, and listen to the sermon of their pastor over the wire.

The most elaborate systems of country telephone connection are found in the thickly populated eastern states. Where the houses are close together the cost of establishing and maintaining a system is proportionately cheaper for the companies establishing it, hence they first seek out such places to do business. Massachusetts is, perhaps, the best field for profitable investment in this line. In that state, especially in communities where the rural population is mostly well-to-do, the use of the telephone by farmers is becoming well-nigh universal. In the more sparsely inhabited western states the telephone people have rarely ventured beyond the wayside villages in the introduction of the 'phone. That is especially true of the central and southern divisions of Illinois, but it is predicted by observant men that, before the end of another decade, the rich farming communities of Illinois will all be in full touch with the outside world through the medium of the telephone. Ohio farmers are considerably in advance of their fellow agriculturists of the Sucker state in the employment of this advantage. A more stable rural population, a larger percentage of owners as compared with renters, and better natural facilities for paying investment are reasons assigned for this advantage.

One of the most interesting illustrations of the effect of the use of the telephone in the country is furnished by the farmers roundabout the little town of Urbana, Champaign County, Ohio. The ruralists on every side of the town are more or less fully supplied with telephones, but those south of the town on Pretty Prairie are especially well equipped. The territory in question includes some forty square miles. Within this territory there is scarcely a house, whether occupied by owner or renter, which does not boast of its telephone. Aside from its practical utility the instrument has its sentimental value, due to the fact that over a dozen of the families are bound together by the tie of blood relationship.

The system here, as is the case in most rural neighborhoods, is what is called an Independent one. Ordinarily the service given is quite as good as that enjoyed in cities of the first class and it is very much cheaper. The farmers around Urbana pay $1 a month or $12 a year for their 'phones. No other expense is imposed upon them. The companies erect the poles and string the wires, making an exception only of such poles as may be necessary to carry the wires from the public highway to the residence. They guarantee to keep the system in good order and to furnish an unimpaired talking service. In case it be necessary to erect poles and string wires for a distance of half a mile or more to reach one or two houses the farmer is asked to sign a contract for the service for a period of five years. This he willingly does, for the experience is that those who have become accustomed to the use of the instrument could not be persuaded to give it up.

The pulpit of the First Presbyterian Church at Urbana is provided with a telephone from this system. The pastor delivers his sermons in ordinary tones of voice and all the patrons of the line, whether one or ten miles away, can hear every word. They can distinguish the words of the hymns sung by the choir and hear the softest notes of the organ prelude, offertory or postlude. The Presbyte-

rian Church has been singled out in this particular system because most of the patrons of the line are identified with that religious denomination. This long-distance listening to the preacher is appreciated, especially by the elderly men and women of the neighborhood who cannot well attend the services in person.

It works beautifully when all the occupants of the lines are content to keep their counsel and let the minister have the floor, but when a garrulous one insists upon making critical comments on the pastor's remarks, he not only breaks the thread of thought for his neighbors, but very likely does violence to the solemnity of the occasion. The whole long-distance congregation went into convulsions once when a cynical listener shouted over the line:

"My boy (referring to the preacher), you'll have to make this a continuous show if you expect to convert the world with that kind of preaching."

The utility of the 'phone has been demonstrated in this community over and over again. Take two illustrations out of many which might be cited. One farmer cleared over $200 on his wheat crop by keeping in close touch last spring with his buyer at Urbana. He had set his heart on a certain price, and the instant that figure was reached he disposed of his grain. Two hours later his crop would have been worth $200 less to him. Two children found a quantity of paris green in a carriage house and swallowed a portion of it. A hurry call from the frightened mother brought a physician five miles from Urbana in less than a half hour. If he had been an hour later, which would have been the case without the 'phone, the poison undoubtedly would have accomplished a deadly work.

WELL-KNOWN HEADS OF WELL-KNOWN HOUSES.

A BIOGRAPHICAL SKETCH OF P. C. BURNS.

The president and controlling factor in the American Electric Telephone Company of Chicago, Mr. P. C. Burns, got an early start in the business and has since retained his interest in its development. While a mere boy of fifteen he started in the business of making acoustic telephones at his father's home under the name of Vicinity Telephone Company, and at sixteen was employed by the Bell company as operator, and later as inspector, in the Chicago exchange. He worked in the factory of the Electrical Merchandise Company, which made apparatus for the Bell company, and afterward was sold to the Western Electric Company. Then he became a traveling salesman for the Railway Telegraph Supply Company, which was later called the Knapp Electric Works.

He started the first electric supply agency on the South Side of the city of Chicago as agent for the Standard Electric Works of Cincinnati, Ohio, and started the first electrical supply agency in St. Louis—the St. Louis Battery Company.

Mr. Burns invented the "microphone" carbon battery, which had a large sale, and disposed of his patents to the New Haven Clock Company, now the National Electric Manufacturing Company of Milford, Conn. He established and conducted the St. Louis Electrical Supply Company, the Findlay Glass & Carbon Company, the Peru Electric Manufacturing Company, the Laclede Carbon & Electric Company (the last two being manufacturers of electric light supplies) and the American Electric Telephone Company of Chicago. He is also president of a number of prosperous telephone and toll-line companies in different parts of the country, and has had an extended and varied experience in the manufacture of electrical specialties. He has, moreover, been successful in all his enterprises. About ten years ago he owned the Rose & Rein Electrical Works at St. Louis and also engaged in the manufacture of apparatus for the Pan-Electric Telephone Company, having large exchanges at St. Louis, Little Rock and other points, but on account of the victory of the Bell company on the receiver patent he was obliged to discontinue for a time. He returned to the telephone field, however, as soon as it was open to independent companies. Mr. Burns built the first vitrified porcelain works in the West—the Peru Porcelain Works, for the manufacture of insulators and fuse blocks. He was the inventor of the Laclede and Hercules batteries and made many improvements in other specialties. He also introduced granular carbon transmitters for sale outright to the trade in this country at least a year before the other companies.

Mr. Burns has always made the independent telephone interests his own, and has done such good work in that field that all of the older telephone men have come to regard him as inseparable from the independent movement, and all admit that his vigorous contest of the patent suits brought

PETER COOPER BURNS.

against several of the independent companies in the early days, all of which resulted in the defeat of the Bell company, was an achievement only to be gained by close attention and perseverance, the success of which made it possible for all independent companies to operate and encouraged others to engage in the business.

Mr. Burns enjoys the distinction of never having lost a single patent suit since he has been in the telephone business, and has been particularly noted for the prompt manner in which he has gone to the aid of all independent companies using his apparatus, who were sued for alleged infringement of patents, and the energetic manner in which he has defended his customers.

Mr. Burns is now devoting his entire time and energy to building up and fortifying the interests of the American Electric Telephone Company, of which he is president, and the reputation and success of that institution is due largely to his untiring efforts.

"Like the publication very much.

R. W. GARNER,
Carthage, Mo."

Telephony.

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THE STORY OF MISSOURI.

In this issue we tell the interesting history of telephony in Missouri. From small and humble beginnings, the Independent movement has knit together the great cities of Missouri and the remotest villages in a network of telephone wires stretching all over the state. Missouri has reason to be proud of her record, and TELEPHONY extends the heartiest congratulations to the Independents who have made Missouri a leading state in the telephone field.

In November the telephone story of Illinois, the banner state of the Union, will be given with profuse illustrations and an extended history of the growth of telephony in that state.

A TERRIFYING POSSIBILITY.

It may be well to say in the beginning that there is nothing more than idle rumor in the story that the 4,000 telephone operators, or "hello girls," of Chicago and vicinity are planning to strike in support of the linemen who are at present "out." But the mere suggestion of such a proposition is sufficiently terrifying. Even people who habitually complain whenever they use a telephone will be ready to admit that the entire silencing of the telephone bells would be little less than a catastrophe. They will admit also, if they give the subject a moment's thought, that the "hello girl" belongs to a much abused class. She is besieged all day by eager, hurried and often irritated and angry men. If sometimes her replies sound sharp and short it should be remembered that her ears are continually bombarded by impatient demands and frequently by unreasonable complaints. Her position is such that she is often blamed for mechanical faults and breakdowns over which she has no possible control. The wonder is not that she sometimes momentarily loses her temper, but that on the whole she maintains such an even, courteous and business-like attitude. The idea of her striking will bring home to a good many people more strongly than ever before the important place which the "hello girl" fills in the transaction of modern business. Meantime it is comforting to reflect that it is not an idea which has found any lodgment in her own sensible head.

LONDON COMMENT ON TELEPHONY.

(From Electricity, London.)

Telephony.—The September number of this interesting monthly contains the "Telephone Story of Ohio," wherein it is stated that during eighteen years the Bell companies had less than 28,000 telephones in use in the state, whereas during the past six years the Independent companies have installed no less than 80,000 telephones. A good map of the state, the main switchboard in Cleveland, together with thirty-three portraits of the various company managers, etc., adorn the pages of the present issue. The writer thinks that the telephone business in the United States is still in its infancy, and that in a few years it will be quadrupled. The paper also contains other interesting articles, and a portrait of the late president.

SUIT FOR LOWER TELEPHONE RATES.

In a bill filed October 2 the city of Chicago and thirty business firms united in asking the courts to restrain the Chicago Telephone Company from all interference with the telephones of subscribers who offer to pay the franchise rate of $125 a year, instead of the $175 charged by the company for business telephones. This suit is a movement of the Illinois Manufacturers' Association against the telephone company's excessive rates. Instead of beginning mandamus proceedings to compel the company to furnish its service at schedule rates, a new shape is given to the proceedings.

The bill was filed in the Circuit Court by Attorney Levy Mayer, representing the association, and was signed by Charles M. Walker, representing the city of Chicago. Thirty firms and corporations are named as complainants in the petition.

It is alleged in the bill that the exaction of a greater sum than $125 a year from the subscribers is against public policy and in violation of the terms and conditions under which the company obtained the right to construct and

maintain its telephone system. October 1 was the first day of the quarter in which, under the contract with the telephone company, the subscribers became liable to pay for their instruments. It is alleged that if they refuse to make the payment at the rate of $175 a year their telephones will be taken away and their business interests injured.

For these reasons the court is asked to restrain the company from interfering with the telephones until the whole matter may have been submitted to the court at the hearing of the suit.

The action is based on the ordinance of 1889, by which the company contracted not "to increase its present or future subscribers' rates for telephone service now established." A schedule of rates was filed with the city clerk upon acceptance of the ordinance. It is signed by George L. Phillips, president of the company. The rate for business telephones in the downtown district was placed at $125 a year.

This rate, it is stated, now has been increased to $175. The territory in which the business telephone service is furnished by the company includes the territory bounded by North avenue, the river, West Division street, Western avenue, Twenty-first street, the South Branch, Clark street and Thirty-first street.

Concerning the business of the telephone company, the bill recites:

"That at the time of its organization, in 1881, the capital stock of the telephone company was $500,000; that from time to time said capital stock was increased to $5,000,000, and again, on or about January 17, 1900, was further increased to $15,000,000; that the total capital stock of the telephone company now issued and outstanding is, as your orators are informed and believe, and state the fact to be, $9,000,000, divided into 90,000 shares of the par value of $100 each, the market value of which stock is now $275 per share, or an aggregate of $24,750,000; that the business of the telephone company has been and now is a large and growing one; that in 1890 the telephone company employed in its service 7,706 telephones and 15,439 miles of wire; that in 1900 the telephone company employed in its service 36,414 telephones and 110,605 miles of wire; that at the time of filing this, your orator's bill, the telephone company owns and has in service over 45,000 telephones; that in 1900 the gross earnings of the telephone company were $3,129,328.18 and its net earnings $870,457.94."

Assistant Corporation Counsel Mason, for the city, said:

"The whole litigation is the result of the opinion by Mr. Walker that the company is bound not to increase its rates."

SOME TELEPHONE COMPARISONS.

An examination of such European telephone statistics as are available in this country reveals that the use of these instruments of communication there, as everywhere, is widespread and frequent or restricted and infrequent, according as the rates are reasonable or high. But the bases of comparison with this country are confused to a great extent by the quite general ownership and operation of these utilities by the government of the municipality in Europe.

Take, for instance, a European city that operates a municipal telephone system, charging only $30 a year for each instrument, and it is not in evidence that this is always profitable to the municipality, no matter how convenient and gratifying it may be to the subscribers. If such a rate were to be compared with what is said to be the average rate in New York City—about $85 a year for all classes of subscribers—it looks remarkably cheap, but it may be that there is a considerable deficit in the municipality's operation of the system, and this, of course, has to be made up from the pockets of the taxpayers, many of whom are not users of the telephone at all.

The city of Berlin has about one-half the population of New York. The average rate charged by the government for the use of a telephone instrument there was about $37.50 per year up to April, 1900. But the number in actual use was over 46,000, while upon a strictly population basis as compared with New York it ought to have had only about half as many here, as say 26,000. It may fairly be assumed that the much greater number of instruments per thousand of population in Berlin is due directly to the lower rates in force there—for, as a general thing, European communities are much slower in adopting the telephone than are American communities, other things being equal. But to what extent that $37.50 rate in Berlin has been profitable to the imperial government is not easily ascertainable; within the past year the rates have been lowered there quite materially, the maximum and minimum rate being now $45 and $16 respectively. It may be inferred from this that there was no loss to the government in the $37.50 rate.

The surprising thing in New York is that capital is so slow and hesitating in seeing its oportunities in telephone investment. If the Bell monopolists have found the business so wonderfully profitable here, there must surely be others who could make it pay handsomely at half the present rate.

THE TELEPHONE, TELEGRAPH AND CABLE COMPANY.

Mr. Charles W. Morse, who purchased the controlling interest in the Telephone, Telegraph and Cable Company of America, makes the emphatic statement that the big company is to remain Independent. In a recent interview he is quoted as saying:

"I wish to say once for all so that the matter may rest that the Telegraph, Telephone and Cable Company of America has but one object and that is to compete with the Bell. The company is absolutely independent and is not backed by either of the telegraph companies. The system will be built up in all sections of the country and in a few years will be able to give a service that will meet every demand. All of the Independent lines will be merged and new communications established. The Independent company is in the field to stay and will naturally push forward."

ATTRACTIVE APPARATUS.

The tendency to make telephone equipments handsome in appearance is not the least of the evidence of progress in telephony. Succeeding the eras of crude inexperience and ugly utility has come the later search for beauty in the telephone. A comparison of the present-day products of telephone factories with that of a half dozen years ago displays as great an improvement in the appearance of the instrument as in its efficiency. The telephones offered by Independent manufacturers are symmetrical in proportion and attractive in appearance. This, together with their efficiency, make them equal or superior to the apparatus in use by the Bell companies. The Independents are quick to learn and have profited by experience so that to-day the apparatus used in this field exemplifies the highest possibilities of the telephonic art.

ILLNESS OF MR. CLEMENT.

Owing to the serious illness of Mr. Edward E. Clement we are unable to publish our monthly digest of telephone patents. This important department will be resumed in November. It is earnestly hoped that Mr. Clement's recovery will be speedy.

The Atchison, Topeka & Santa Fe Railway is making a practical test of using telegraph wires for telephone and telegraph purposes simultaneously. An experimental line, two miles in length, between Leavenworth and South Leavenworth, Kan., has been equipped under the supervision of Mr. C. G. Sholes, superintendent of telegraph.

THE FINDLAY HOME TELEPHONE COMPANY.

One of the best equipped and most modern in every way is the plant of the Findlay Home Telephone Company at Findlay, Ohio, which has only recently been opened for business. The construction of this plant stands unrivaled, and the result is one of the most modern exchanges there is in the country.

The plant is entirely new property, all material used in its construction being standard. It was built by the Reserve Construction Company of Cleveland and was started in the fall of 1900 and was practically completed for 750 aerial lines and 1,120 switchboard capacity June 1, 1901.

In addition to the main exchange at Findlay an estimate has been prepared with the idea of reaching out for farm line business in Hancock county. Some 300 subscribers of this class have already been obtained, and over 150 farm lines are in actual operation. This latter construction includes several switching stations. The plant has about 30 miles of toll lines, including from 25 to 60 foot poles, some 3,200 cross-arms and some 800 drops strung. There is also about 5,000 feet of subway. The total amount of wire used in distributing this system, not including the switchboard and instruments, but including the wire in cables, is over one million feet.

The switchboard, which was manufactured by the North Electric Company at Cleveland, Ohio, was made for an ultimate capacity for 1,500 and is installed for 1,120. The switchboard is of the automatic calling type with full clearing-out signals and automatic restoring line signals. In the switchboard 150 lines are allotted to each operator's position, also 15 cord circuits.

The telephones, which were manufactured by the same company, are of the central signaling type, with cabinet work for transmitter batteries, and two dry cells are used at each 'phone. There were in service on July 1 685 'phones, but this has been increased to 900, and now new cable is being added. Lightning and current protection is provided at each telephone at the exchange end of the lines. The officers of the company are: Edward C. Taylor, president; John D. Snyder, vice-president; John C. Firmin, secretary; W. J. Burkett, treasurer, who, together with W. S. Wagner, James B. Hoge and W. B. Woodbury, make up the board of directors.

At the present time in Findlay there are 1,400 contracts, and, as stated before, over 900 'phones in service. The new telephones are being put in as fast as material can be rushed to the ground. The company is capitalized for $150,000, and the authorized bond issue is for the same amount.

SWITCHBOARD ROOM, THE FINDLAY (OHIO) HOME TELEPHONE COMPANY.

Findlay is one of the central points of the oil industry in the Ohio belt, and is one of the most progressive and wealthy cities of its size in the country. The development of the Findlay company has been with a special reference to taking care of oil leases and other property, along with their farm line work. The population of the town is 20,000, and it is the county seat of Hancock county. The Findlay company is to have exchanges at Arcadia, Arlington and other towns in the county. The plant was built under the direction of Mr. A. C. Morse of the engineering department of the Reserve Construction Company and under the general supervision of Mr. Maxime Reber as consulting engineer.

EUROPEAN TELEPHONE SYSTEMS.

In the matter of cheapness of service and number of subscribers, European countries appear to be far in advance of America in the telephone business. Although the telephone is an American invention and has been developed by Americans to its present stage of perfection, the people of

EXCHANGE BUILDING, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

the older countries seem to have the faculty of eliminating the monopolistic features from its control and bringing it to a greater number of patrons at a low price.

Franz J. Dommerque, connected with the engineering department of the Kellogg Switchboard & Supply Company of Chicago, has recently returned from an eight months' tour of European countries with a vast amount of information concerning the telephone situation there. He is of the opinion that while Europe can learn a great deal from the United States in up-to-date methods of construction and installation, we can learn much from the older countries in management and in making low rates for the best service obtainable.

He found that the people of Europe were willing to pay for the best equipment which the market affords, but they are also careful to see the plants are not monopolized and the rates made almost prohibitive, as they are in this country by the Bell Company.

"While in Europe," said Mr. Dommerque, "I visited the principal cities of England, France, Belgium, Germany, Austria-Hungary and Russia.

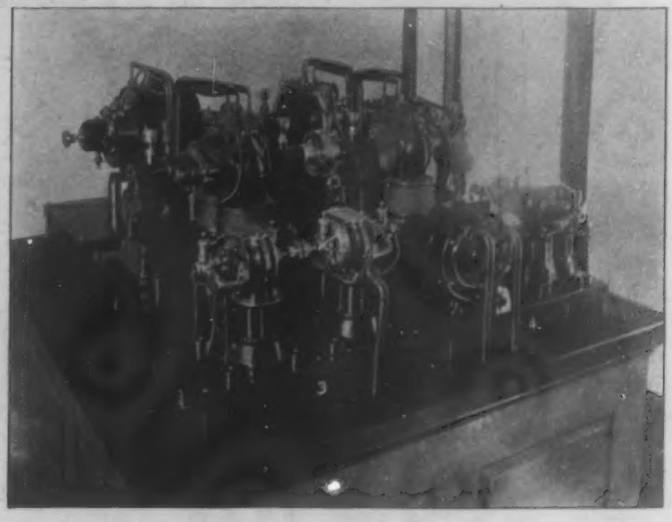
"As a rule they are about five years behind us here in their equipment. That is to say, they are still using the old switchboard of drops, whereas we now have the light signals.

"England is just beginning to pull up with the United States, but Germany, of the European countries, is perhaps

REAR VIEW SWITCHBOARD, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

giving the best service with the old switchboards. In London the rate for telephone service, for both business and residence, is $100 a year and is furnished by a private company.

"The British government, however, is putting in a switchboard constructed in America and will be up to date



POWER PLANT, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

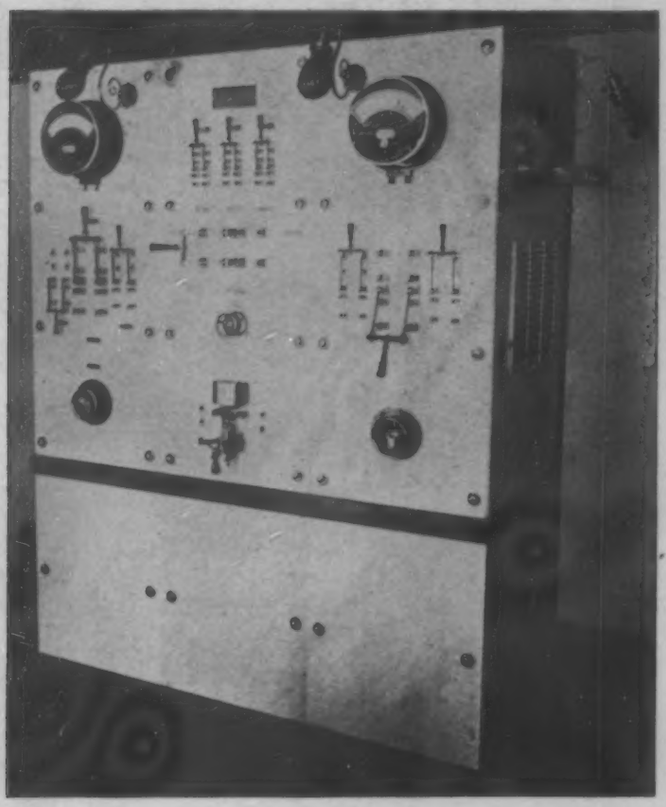
in all respects. The government at present owns all the toll lines in England and Scotland and in time will own all the exchanges. The one now under construction in London is beginning in that direction.

"The service rendered at present in London by the pri-

vate company is very unsatisfactory. One reason for this is that the company is not allowed to place any of its wires underground; they are forced to put them all overhead. The result is that they are compelled to have a great number of sub-stations, and it sometimes takes twenty minutes to get a connection. I was told they have in London and its suburbs all of forty exchanges.

"The government prohibits the company from laying conduits, because it wants to do that itself. In fact, conduits for the new government telephone are now being laid. It looks as if the government had concluded that telephone service controlled by a private company would only be temporary, and for that reason is unwilling to let it occupy conduits.

"In Germany they are still using the old-style switchboards, but the service is excellent and the prices low. Take Berlin, for example, with a population of about 2,000,000, or



POWER BOARD, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

about the same as Chicago. The price for unlimited service is $50 a year for both residence and business. They have 45,000 telephones in use and a complete toll system to all parts of the empire.

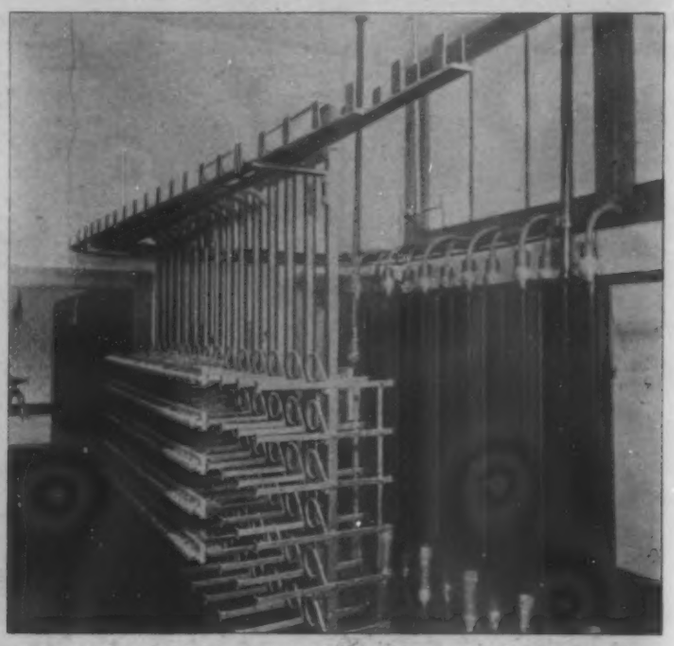
"In Chicago, with the same population, they have less than half that number of telephones, the Bell monopoly controlling the field there.

"The toll rates between cities are also very low in Germany compared with the rates in this country. For a telephone message about ten miles out of the city the rate is 2½ cents, 5 cents for twenty miles, 7½ cents for forty miles, 12½ cents for seventy-five miles, and so on in proportion. You can telephone any place in the German empire, or a distance of 750 miles, for 50 cents, which is the highest charge.

"From Berlin to Paris the rate is only 75 cents. These prices are about one-quarter of the toll rates charged in the United States.

"Telephone service in Germany has not yet been extended to the small country places as much as it is here, but in the small towns the rate for unlimited service is $12.50 a year.

"Another big advantage there is that the telegraph, postal and telephone systems all co-operate for the good of the people. If you want to telegraph to someone at some town where there is no telegraph office you can send the message to the nearest telegraph station and it is transmitted by telephone or postal, as the case may be.



TERMINAL ROOM, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

"In France the government owns the telephones, but its system of management is not working well. They require each subscriber to buy his own instrument and connections and then charge him a yearly rental for the use of the lines. This makes it more expensive than in Germany, and as a

POLE LINE, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

consequence the users are not so numerous and progress is slow. In Paris the rate is about $100 a year. One man told me it cost him $250 the first year for getting his telephone installed and for rental.

"Austria-Hungary is more progressive. They are getting American switchboards, or, rather, they are contracting

for them, providing that three-quarters of the work is done in the country. The same low charges prevail as in Germany.

"Russia is the one country in Europe that I know of which has felt the iron heel of Bell monopoly. The International Bell Company has a system in operation in St. Petersburg and the price charged is $140 a year. Its contract will terminate next November and the Russian government has already made arrangement to install a modern system and give a service for $40 a year. All other Russian cities will then receive a similarly reduced price, as the government has determined to prevent the Bell Company from longer continuing its big prices. It is calculated that the subscribers next November will be doubled within a month in St. Petersburg when the low prices go into effect.

"I found that Russia was very progressive in all

POLE LINE, FINDLAY (OHIO) HOME TELEPHONE COMPANY.

branches of electricity. There is no prejudice against foreign devices and manufactures if they are better than can be had in their own country.

"Belgium I found more progressive than France. What it has done and is now doing compares favorably with Germany in telephones. They are putting in modern equipment.

"I was not in Sweden and Norway, but I heard a great deal about their great progress in telephony, so far as the low prices and number of subscribers are concerned. In Stockholm, they tell me that many of the private residences have telephones in several rooms, and that most of the poorer class of people are able to have them in their homes. It is common for the hotels to have a telephone in each of the rooms.

"One reason given for this low price of service is the low cost of manufacturing the equipment. Apprentices in the manufacturing establishments work the first three years for nothing just to learn the business, and then they are paid very low wages for another three years. It is said that these factories, therefore, have always 150 men working for nothing and boarding themselves, and another 150 working for very little.

"All over Europe I found the tendency to be toward the installation of large exchanges, instead of dividing a city into sections, as is now the custom, and having an exchange in each district. They find that it takes too much time to make connections with these branch exchanges, besides being much more expensive to maintain. There is also a greater liability to mistakes on the part of the operators, causing annoyance to patrons."

LETTERS TO TELEPHONY.

TELEPHONY, Chicago, Ill.

Gentlemen:—Allow me to suggest that a telephone message be called a phon-o-gram.

Respectfully yours,

W. I. CARPENTER, E. E.,
Worthington, Minn.

Telephony, Chicago, Ill.

Gentlemen:—"What shall the word be?" I think telephogram should be adopted.

Yours truly,

C. C. PROVERB,
Cambridgeport, Mass.

TELEPHONY, Chicago, Ill.

Gentlemen:—In the September number of TELEPHONY the question is asked, "What shall we call a message sent by telephone?" Allow me to suggest that telephogram be the word. Yours truly,

CHARLES C. HOWARD,
Montreal, Can.

TELEPHONY, Chicago, Ill.

Gentlemen:—Referring to your inquiry, "What Shall the Word Be?" I respectfully submit for consideration the word vocal-i-gram, as a name to be adopted for telephone messages. Yours respectfully,

H. P. COPELAND,
New York, N. Y.

Telephony, Chicago, Ill.

Gentlemen:—I received your journal entitled TELEPHONY, of September, 1901, and have read it with very much interest, especially the article entitled "What shall the word be?" And after carefully reading the same I have concluded that the word "telephogram" would be a very suitable word to use in the place of telepheme, or any other word that has been suggested by others, and I have presented the same to quite a number of educated people and they all with one accord have urged me to write you and place it before you as my suggestion.

Yours truly,

FRANK DALRYMPLE,
Hicksville, Ohio.

TELEPHONY, Chicago, Ill.

Gentlemen:—Over a quarter of a century has passed since the first conversation was held over a closed circuit telegraph wire, and yet the question is asked, "Who invented the telephone?" Five Supreme Court justices heard evidence and three said, "Bell was prior to Drawbaugh," while two said, "Drawbaugh anticipated Bell." The three justices thus fixed a date when the first telephone talked. But who discovered that a telephone would talk prior to March 7, 1876, has never been ascertained. Yet, in February, 1885, a patent was issued by the patent office, signed by the late Benj. Butterworth, who declared the patent of 1885 to be the original patent to the original inventor. This patent, No. 312,670, can be seen in the reports of the patents issued to inventors, now in the public libraries. The foundation for this patent was based on the inventions of Dr. Everett of New Orleans, La., 1863-1868. This is all there is to the entire controversy about the first invention of the electric speaking telephone. Yours truly,

HENRY C. STRONG,
Chicago, Ill.

PECK'S LUCK.

BY WILLIAM LIGHTFOOT VISSCHER.

There was a time when people of "The States" thought that Cheyenne, Wyo., was "the jumping-off place," and, indeed, it was once, for it was the temporary terminus of the Union Pacific railroad, and at that time it was a town of "shreds and patches." It was a slab town, and a tent town, and altogether a "wide-open town."

Here in those days were gathered all manner of fugitives from justice, as well as the well-meaning adventurer and he who had gone West to "grow up with the country."

WILLIAM LIGHTFOOT VISSCHER.

The town was a wild one, that's a fact, and it was then that it got so hard a name that the toughest purlieu of Chicago came to be called "Cheyenne." But Cheyenne got even on that, for when it grew to be a beautiful and well-ordered city it named its toughest precinct "Chicago."

The time came when Cheyenne was the best built city of its size in the United States; when its per capita, financially speaking, was the greatest of any city in America; when abject poverty was unknown within its limits, and it was gay, enterprising and altogether lovely.

Cheyenne was the first city in the world to light its streets by electric arc lights, and the first in which the incandescent light was farmed out for use in residences and places of business. It was among the first cities to use the telephone, and thereby hangs a tale.

Editor Clark had a private telephone, the wires of which reached only between his den in the newspaper building and his home in the suburbs. When the baby cut a new tooth, and that important fact became known to the young mother shortly after Editor Clark had gone down town, the news came on the telephone so quickly to him that it was "a scoop" upon the balance of the world, not to speak of the other newspapers in Cheyenne. And if the society editor became aware of the fact that Mrs. Terry Seck was going to give "a pretty pink tea" next Thursday afternoon, Editor Clark stammered the news over the telephone to his wife and her pretty maiden sister with a suddenness and dutifulness that was as commendable as it was beautiful. Then the private telephone was a thing to be desired—for a long time. But satiety comes at last, in nearly all sweet things. The baby's teeth came very frequently, once they got a habit of that kind, and pink teas came to be so fashionable that they were numerous enough to hamper Editor Clark, in their telephonic detail.

Other household happenings kept Editor Clark dancing from his chair to the transmitter, till the carpet along that route became disreputably threadbare, and one day it occurred to the editor that Frank Peck, who had lately come to be the "city editor," might just as well as not do a few turns at the telephone.

The "city editor" of a newspaper in a town like that had so little to do that any addition to his duties was hardly to be felt.

Such a city editor was, in fact, the entire staff—barring the editor-in-chief and the society editor. He hunted up and wrote down the local news entirely, filled out the "flimsy"—which was the manifold sheets that the Associated Press dispatches came on—read all the proof slips, from editorial to "want ads.," superintended the "make-up," as much as the foreman would allow, and only stopped short of "carrying a route" from sheer necessity for a little sleep, and some minutes, occasionally, at the place where he had a meal ticket.

Peck, city editor, was a man of fewer years than he looked. He fancied that he had been oppressed with weighty troubles, and a serious aspect had chosen him for its own. But he was a bright fellow who knew his business, from one end to the other, in all its multifarious details, something that he had learned from similar experiences in a dozen years on nearly as many newspapers of the same class in as many different cities of much the same character.

"For heaven's sake, Peck, see what's wanted on that blooming telephone, will you, please?" said amiable Editor Clark one evening when the bell rattled at the point where Editor Clark was in the very middle depths of a heavy dissertation upon "The Outlook of the Republic," or some other pressing question of political or domestic economy, and Peck darted to the fore—or whatever it is.

"Hello! Hello!" said Peck, with the originality usual under such circumstances.

"That you, Sam?" (Editor Clark's other name was Sam.)

"No, it's Peck."

"'Scuse me, who's Peck?"

"Oh, just a reporter named Peck."

"Where's Sam?"

"Gone out." (Editor Clark had been called by the foreman and had gone upstairs.)

"What's Mr. Peck's other name?"

"Frank, I think."

"Oh! Good evening!" (Haughtily.)

"Evenin'." (Meekly.)

Peck returned to his table and looked sadder. He drummed on his pad of soft paper with the rubber end of his pencil and thought. The most of his thought may be summed up in the remark that he ejaculated before saying: "Oh, pshaw!" and the remark was:

"How like it!"

Some months before Peck came to Cheyenne he had been employed as "city editor" on the Buena Vista "Bugle," and in that mountain metropolis he had met Louise Dayton, a young lady who at the last "commencement" had graduated from the Beautiful View Seminary, very properly located at Buena Vista.

Louise was the loveliest creature on earth—according to Peck—and Peck had therefore become more utterly, entirely, irrevocably and idiotically in love with this "lovely creature" than with any other of the sixteen or twenty that at one time or another had flitted across the scenery of this susceptible young man's life, thereby causing him more or less of the alleged trouble that has been suggested heretofore in this chronicle.

Louise had been charmingly receptive in the matter, and the two had exchanged vows that would have been models for a secret society of Eligible Lovers, and when the young lady took her departure for home she gave Mr. Peck her address, and he was to write to her very often. Later he was to visit her and obtain the consent of her parents, and thus the road to Elysium was blazed through the primeval forest of Love.

But on the following day a telegram came to Peck that he was wanted on a Denver paper as a reporter. This was promotion, and a furtherance of the matrimonial scheme.

Peck, in the meantime, lost Louise's card, and he could

not remember the name of the little town her parents lived in if his life had been dependent upon it.

Miss Louise compromised with her maiden reserve and wrote to Mr. Peck, very coolly—with a string to the ice—but Peck was gone and nobody in Buena Vista knew where—or cared. Peck had never stayed in one place long enough for anybody to become specially interested in him—save his sweethearts and the restaurant man, and they soon forgot.

Having said "Oh, pshaw!" several times, thus to shake off a great pensiveness, a vagrant idea at last struck Mr. Peck with much force.

Editor Clark had a vagabond sort of brother-in-law—as good men often have—who was not allowed about the newspaper establishment, but before Peck had become aware of that situation, this brother-in-law, upon the strength of his relationship to the editor-in-chief and proprietor of the newspaper, had borrowed sundry bits of small change from Peck.

Peck remembered that this brother-in-law to the man who owned both ends of that private telephone wire was named Dayton, and as Peck had some ingenuity, he added together "Dayton" and the voice that had made him say, "How like it!" and a haughty, "Oh! Good evening!" and when Editor Clark came in Peck asked, in a different sort of way:

"Do you happen, Mr. Clark, to know a young lady named Miss Louise Dayton?"

"Well, yes, I happen to. That is the name of a young lady who happens to be my wife's sister, and who happens to be visiting us just now. Why?"

"Oh, nothing! I happened once to be acquainted with a young lady of that name."

The balance of this story is easy. Except, it may be added, that Frank Peck, considerably later on, became one of the partners in the ownership of that Cheyenne newspaper and brother-in-law to the editor-in-chief.

The telephone is often a potent factor in matters of this kind, as well as other more or less important things.

DECISIONS AFFECTING TELEPHONY.

PREPARED FOR TELEPHONY BY ANDREWS & MURDOCH, BERRIEN SPRINGS, MICH.

ERECTION OF POLES ON HIGHWAYS.

The case of Halleran vs. Bell Telephone Company of Buffalo, 71 N. Y. Supp., 685, has an important bearing on the right of telephone companies to erect poles on public highways.

Halleran was the owner of land up to the highway, and he brought the action to compel the removal of the poles which had been erected along the road in front of his land. Halleran never had any title to the highway itself, the record title of the latter being in the Holland Land Company, which had conveyed to the telephone company the right to erect its poles thereon. The case was disposed of upon the basis that plaintiff had no title whatever to the highway and that he had no other or different right to it than has any one of the public, except so far as being an abutting owner, it was necessary for him to use the highway as means of access to his premises. The court held, "An encroachment which does not interfere with the right of passage over a highway, gives no right to a citizen, who is not to some extent inconvenienced by it, to interfere with it. It certainly gives him no right to require its removal. If it constitutes a nuisance, and interferes with the general right of the public, the public alone can compel its removal, but no private individual can interfere with it, except so far as it constitutes as to him a private nuisance. The finding is that the telephone poles do not interfere in any degree with any right which the plaintiff has as an abutting owner. When that fact was made to appear, we are utterly unable to conceive of any reason why the plaintiff should be entitled to maintain this action. If the plaintiff were the owner of the land to the center of the highway he would have his right of action either for damages caused by the erection of the poles and the cutting of his trees, or perhaps would be entitled to an injunction to compel the removal of the poles." But in the present case, except so far as the erection of the poles has interfered with the plaintiff's right of access to his own land, he has not suffered any damage, and he cannot maintain an action to compel the removal of the poles.

TELEPHONE LINES PERSONAL PROPERTY.

Whether telephone poles and wires and insulators on the same are real or personal property depends upon the conditions and purposes attending their erection.

The question came up in the action of Beadfield Telephone & Telegraph Company vs. Cyr, 49 At. Rep. (Me.), 1047. The property of the Dirigo Telephone Company had been sold on execution as personal property and purchased by the plaintiff. The only question involved was whether the line as between debtor and creditor was personal property at the time of the levy. The Maine statutes gives a telephone company the right to erect and maintain lines along public highways, but it is forbidden to do so without first obtaining a written permit from the municipal officers, "specifying where the posts may be located, the kind of posts and the height at which and the places where the lines may be run." Nor is this permission, when once obtained, final and irrevocable, and the use so granted subject to be determined only by the will of the company or the discontinuance of the highway. The same section further provides that "after the erection of the lines, having first given such company, persons, associations, or their agents, opportunity to be heard, the municipal officers may direct any alternation in the location or erection of said posts." In view of these provisions of the statutes the court held, "The telephone company then has no interest in the soil which supports its posts and lines, except a right to occupy it by the permission of the municipal officers—a mere license revocable at their will. In conclusion they said, "from the facts of this case no legal inference can be deduced of an intention on the part of the Dirigo Company to annex permanently its posts and the insulators which they supported to the freehold, and make them a part and parcel thereof, that they continued, as between debtor and creditor, to retain their original character as chattels."

EXTENSION SERVICE.

The right of subscribers to connect extension service with telephones furnished them by companies having exclusive franchises is denied in the case of Gardner vs. Providence Telephone Company, 49 At. Rep. (R. I.), 1004. Gardner is a physician and connected a long-distance desk 'phone with the office 'phone furnished him. The company threatened to remove its 'phone from his office unless he discontinued the use of the extension 'phone. Gardner brought suit to restrain the threatened removal, but his application was denied. The court based its decision upon the mechanical difficulties which are connected with the service and held that the company had the right to the complete control of its wires and connections.

A NEW BOOK.

The Bridging Book, which has been issued by the Chicago Telephone Supply Company, is a great missionary. It is printed on the best and highest priced paper procurable. It is full of argument that will appeal to the farmer and his family; therefore it will be a great aid to promoters of rural lines, regarding the material needed to construct rural lines, how such lines should be constructed, how they should be cared for and how "trouble" in telephones or on the line may be located and cleared up.

A copy of this book should be in the hands of every telephone man, and will be sent free to readers of TELEPHONY on application. Write to-day to the Chicago Telephone Supply Company, Chicago, for the bridging book.

THE IDEAL SELECTIVE LOCK-OUT PARTY LINE SYSTEM.

The United States Electric Manufacturing Company of Butler, Pa., incorporated under the laws of New Jersey, with a capital stock of $500,000, have purchased the patents of the Drake Telephone Company, covering the Drake selector and battery cut-out, and have made various improvements on the system, on which patents are now pending.

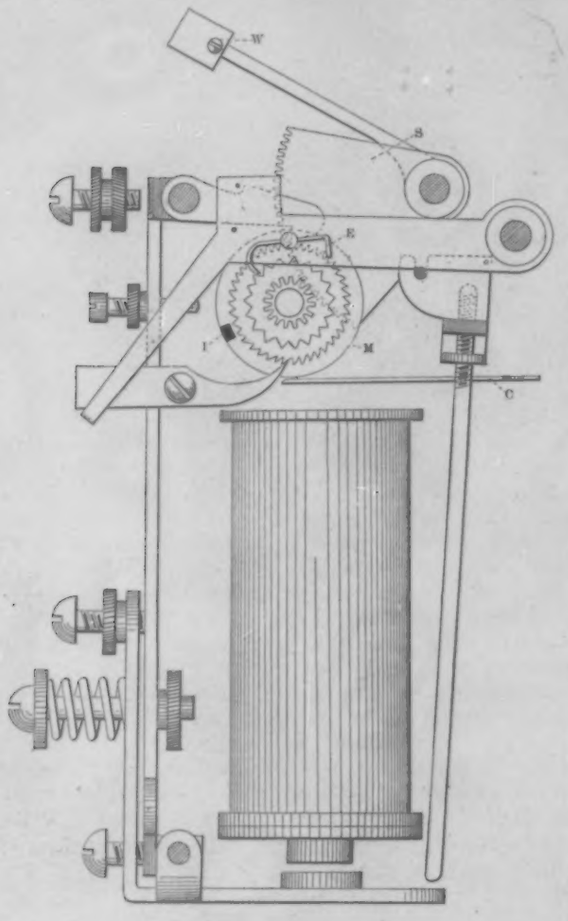


FIG. 1—AUTOMATIC BATTERY CUT-OUT.

The officers of the company are: J. W. Brown, president; M. A. Berkimer, vice-president; C. A. Bailey, treasurer; W. H. Miller, secretary; all prominent business men of Butler, and Fred E. Freers, superintendent, formerly superintendent of equipment of the Pittsburg and Allegheny Telephone Company.

At present the company proposes to manufacture the

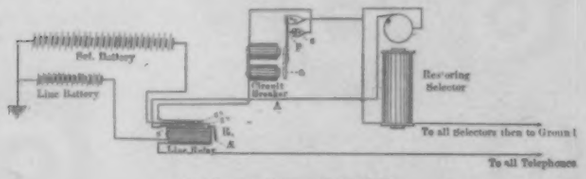


FIG. 2—LINE CIRCUIT.

Ideal selective lock-out party line system for exchange service, and the Ideal automatic exchange system for farmer's lines, hotels, factories, office buildings, small towns needing only a limited number of telephones, and in fact a system adapted for any kind of service which can be handled by an automatic exchange. The Ideal selective lock-out party line system can be applied to any exchange board and is especially adapted to farmers' lines, as any number of telephones up to 35 can be operated on one line, and has the following advantages over the ordinary party lines:

Only the subscriber called for is rung, as the station is selected automatically, and the telephone desired is the only one on the line, this does away with having different signals for each station and also the annoyance of ringing all subscribers when calling anyone.

The system is also a lock-out, by which all telephones

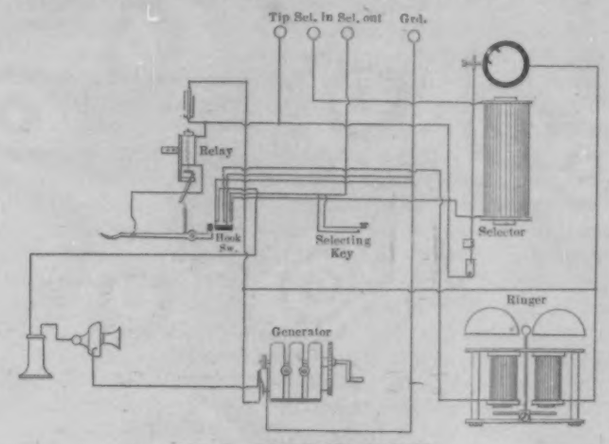


FIG. 3—TELEPHONE CIRCUIT.

are locked out but the one using the line, which insures the user of an absolutely private conversation.

Practically, the system enables the operating company to give an independent service at party line rates.

FIG. 4—SELECTIVE LOCK-OUT PARTY LINE TELEPHONE.

The automatic exchange system is entirely automatic, each subscriber connects himself with any other one desired, and is also a lock-out system.

Fig. 2 is the line circuit and the automatic device, it consists of the line battery, selector battery, line relay, cir-

cuit breaker and the restoring selector or battery cut-out, all batteries being worked on open circuits.

By taking the receiver off the hook (Fig. 3) a wipe contact is made grounding the tip of the line which pulls up the line relay (Fig. 2), which closes selector battery through

FIG. 5—AUTOMATIC DEVICE.

circuit breaker and also closes telephone circuit at relay (Fig. 3), which in turn holds the line relay up after the wipe contact is broken. The selector battery is now open at the selecting key (Fig. 3), which, when closed, immediately starts the circuit breaker which stops all selectors on the line when station desired is reached, as shown by the dial and indicator

FIG. 6—AUTOMATIC DEVICE.

on the telephone (Fig. 4), the selector key is released and the party is called by the usual method.

By hanging receivers up on the line the line battery is opened (Fig. 3) and line relay drops back, thus throwing the selector battery direct out on line and restoring same to normal condition.

The selector battery is opened automatically by restoring the selector (Fig. 1), which is operated as follows, and is stepped or revolved in unison with all telephone selectors. When not in use the insulated point I rests on the spring C, which opens the selector battery at that point; when a station is being selected, the point I moves around and an electrical contact is made between the disk M and spring C.

When restoring battery is thrown out on line the disk M is restored to its normal position, its motion retarded by the escapement E for the purpose of giving the telephone selectors sufficient time to restore before battery is cut off.

The full selector circuit is as follows (Fig. 2): The battery goes to middle spring on relay line, when relay is up the battery goes through top spring to circuit breakers and through it to the line, where it is open until selecting key (Fig. 3) is closed, to select a station.

When line relay is dropped by hanging up receivers the selector battery then goes through lower spring of line relay, to restoring selector, where it goes out on the line through disk M and spring C (Fig. 1), and also through the coils of restoring selector, when this is done the circuit

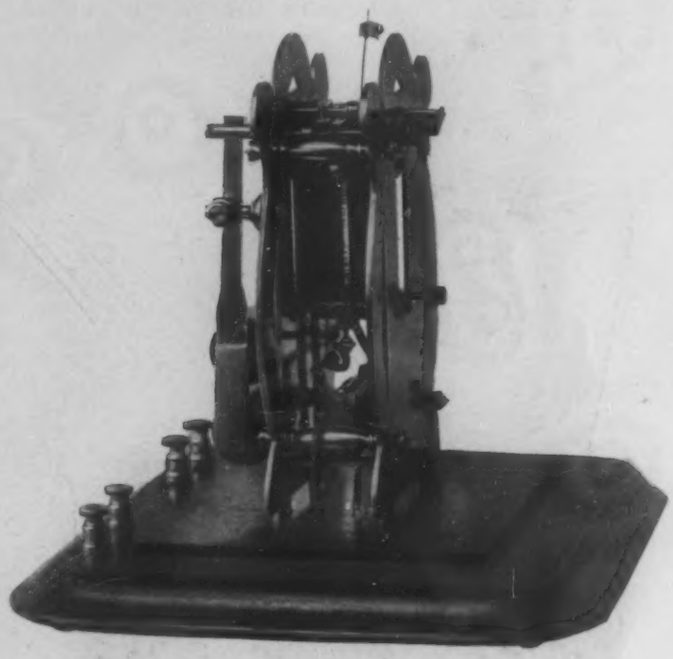


FIG. 7—AUTOMATIC DEVICE.

breaker is not in the circuit, which allows additional current to restore the selectors to normal position, this can be seen by tracing the circuit through in Figs. 1, 2 and 3.

Figs. 5, 6 and 7 are different views of the automatic device for operating a line.

The equipment will be ready in a very short time to put on the market as the factory is now running and making the different parts. Correspondence is invited from prospective purchasers.

NEW DESIGN OF TRANSMITTER.

A new form of microphone has been designed by Mr. J. E. Keelyn. The mechanical lines (cast back and front) and exterior design of the well known Keelyn transmitter are closely adhered to. However, the interior construction has been greatly improved upon by reducing the area of current exposure of the electrodes, and in placing the "active" carbon granules within close range of the center of diaphragm vibration. The new arrangement provides an adjusting means for variable resistance, in a manner so unique that it is a simple matter to adapt it for use on central energy or any other system. A special novelty is the provision of platinum electrodes for the first time in granular carbon transmitters. It is said to be much superior to gold for the purpose. The Keelyn Telephone Manufacturing Company has adopted this for its new 1902 telephones.

THE LEEDS PORTABLE TESTING SETS.

Those who manufacture telephone apparatus and those who use it have frequent occasion to measure "ohms" as represented by the resistance of magnet windings, line connections, etc., and the question is to secure accurate results with satisfactory speed. The instrument herewith described and illustrated was designed for work of this character, and that it has met the conditions is evidenced by the large number of telephone companies that have placed orders with the manufacturers during the past two or three years.

The Leeds portable testing set consists of a wheatstone bridge with rheostat, sensitive D'Arsonval galvanometer, battery and contact keys, all mounted in a handsome hard wood carrying case as illustrated. The theoretical range of the instrument is from .001 to 11,110,000 ohms, but those familiar with the subject will recognize that the wheatstone bridge principle is such that accurate measurements can hardly be made through such a very wide range. Two grades of accuracy are provided, in one of which the bridge coils are correct within 1-10 of 1 per cent and the rheostat coils within 1-5 of 1 per cent; while in the other the bridge coils are accurate within 1-20 of 1 per cent and the rheostat coils within 1-10 of 1 per cent. These two grades are designated respectively as "Grade B" and "Grade A." The accuracy of results that can be obtained with the Leeds portable testing sets has been worked out very carefully and may be stated approximately as follows:

LEEDS PORTABLE TESTING SET.

	Probable Accuracy of Measurement.	
Resistance to be Measured.	Grade B.	Grade A.
.01 ohm.	.4 of 1%	.025 of 1%
.1 ohm to 100,000 ohms.	.5 of 1%	.125 of 1%
1,000,000 ohms.	2%	2%

If an outside battery of 50 or 100 volts is used in place of the few cells mounted in the set, a proportionately greater accuracy will be obtained in measuring high resistances.

Printed instructions are pasted in the lid of the set and additional data is contained in a special pamphlet supplied with each instrument, so that anyone with reasonable intelligence can learn to manipulate the apparatus very quickly.

M. E. Leeds & Co. of Philadelphia, Pa., manufacture the Leeds portable testing sets, but all correspondence should be addressed to their sole selling agent, Mr. James G. Biddle, No. 1021 Stephen Girard building, Philadelphia. Interested parties will make no mistake by writing to Mr. Biddle for a copy of pamphlet 340, which fully describes the apparatus mentioned in this article.

MEASURED SERVICE.

BY W. A. FOSS.

Very little attention has been paid by the Independent telephone companies to measured service. This class of service has long been a source of great revenue to the Bell companies and they are rapidly changing wherever possible, to so much per call. This, we think, is the only fair and equitable way to charge for telephone service, as very few people object to paying for what they get if the charges are within reason.

It is hardly fair to charge Smith who has but two or three calls per day the same rate per month as Jones who has from two to three hundred per day. You are either charging Smith too much or Jones too little. The first-class hotels

MEASURED SERVICE REGISTER.

are fast coming to the European system of charging for what you get. The dyspeptic who orders two soft boiled eggs and toast should not be compelled to pay the same price that the rosy cheeked drummer does who orders canary bird tongues a la something and everything else on the bill of fare. You would hardly expect your grocer to furnish your family of five or six with groceries for the same amount he receives from the young couple next door, but this is exactly what you are doing with your telephone charges. Do you think that the Western Union or Postal Telegraph companies would consent to do business in this manner? and they are handling practically the same class of business.

Suppose that when you first started to do business that you had one thousand subscribers and you charged them each a flat rate of say thirty-six dollars per year, and that you now have two thousand subscribers or just double the number you had when you started, the service is now just double the value to your subscribers as it was then.

If your service was worth thirty-six dollars per year then and you now have double the number of subscribers your service would be worth seventy-two dollars or double, but are you receiving any more per 'phone than when you started?

If you were operating under the measured service plan you could get pay in proportion to the amount of business you are doing, and you would not be doing business with anybody at a loss and your lines would not be kept busy with nonsense as they are at present. With measured service your receipts would increase with the number of telephones you have in operation, and the only way you can make larger returns for your company is through measured service.

TELEPHONY, Chicago, Ill.

Gentlemen:—A message sent by telephone should be called a vocal-gram. Very truly,

H. C. STRONG.

Chicago, Ill.

TRADE NOTES.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, New York and Chicago, is making shipments of supplies to Shanghai, China.

THE CHICAGO TELEPHONE SUPPLY COMPANY, Chicago, will send its latest fifty-page illustrated catalogue number 38 upon request.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has issued neat supplementary circulars giving full information regarding its new number 36 cabinet type wall telephone.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, will be pleased to send upon request "Bulletin number one," containing a complete list of linemen's construction tools, insulators, etc.

THE ACME ELECTRIC COMPANY, Chicago, will send to anyone interested its latest catalogue and folder describing Acme apparatus generally and Acme telephones in particular. Correspondence is invited.

WILLIAM J. MURDOCK & COMPANY, Chelsea, Mass., are calling attention to their "Solid" receiver, which was patented August 14, 1890, and which is being used by some of the leading exchanges. The company's leaflet on receivers will be sent postpaid upon request.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, has just issued number two of volume two of the American Telephone. The journal contains a great deal of valuable information and is edited by Mr. C. E. Kammeyer.

THE EUREKA ELECTRIC COMPANY, Chicago, has just put on the market a new toll switchboard for small exchanges which is claimed to possess many points of merit. The company will send its catalogue upon request which fully describes this board as well as all the other Eureka apparatus.

THE D. A. KUSEL TELEPHONE & ELECTRIC MANUFACTURING COMPANY, St. Louis, will mail its new catalogue, describing the company's complete line of telephones, switchboards, construction material and supplies. There is a great deal in the book of interest to telephone men.

THE CHICAGO TELEPHONE SUPPLY COMPANY, Chicago, has removed its factory and general offices from 20-32 West Washington street to 133-139 South Clinton street, where, with new machinery and increased facilities, the company will continue to demonstrate the fact that "Chicago telephones satisfy."

THE ELECTRICAL ENGINEERING COMPANY, Minneapolis, Minn., one of the largest electrical supply houses of that section of the country, reports through its secretary and treasurer, Mr. George W. Heyford, a decided increase for general electrical supplies throughout the Northwest with the opening of the fall season.

THE YURGAE SIGNALPHONE MANUFACTURING COMPANY of Milwaukee is equipping the lines of the New York Cab Company with signalphones in place of the call boxes which have been in use. Mr. Weller has charge of these improvements. The company is also installing its apparatus with the A. D. T. Company of New York.

THE HAZARD MANUFACTURING COMPANY, Wilkesbarre, Pa., is making an attractive exhibit at the Pan-American Exposition of its complete line of insulated wires and cables, also samples of its wire rope manufactures. The company was established in 1848, but recently extended its works to include the manufacture of electrical conductors. The range of these latter products includes weatherproof and rubber covered wires and cables, magnet wires of all shape, cotton and silk covered, and special conductors. The company is distributing at its Pan-American booth two handsome pamphlets descriptive and illustrative of its products, in both of the above named lines. Views of the various departments of the electric wire mill are shown, together with illustrations of wire samples. The pamphlet on wire rope products is completely and attractively illustrated.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, reports shipments of thirty-seven switchboards for the last week in September and first week in October, thirteen of which were magneto and the remaining twenty-four common battery boards. The shipment for Saturday, October 5, was eight switchboards, five of which were magneto and three common battery.

THE INTERNATIONAL PUBLISHING COMPANY, Grand Rapids, Mich., is making a special offer of its telephone circuits as follows: 15 magneto combinations, 50 cents; 11 central energy and house systems, 50 cents; 15 wiring of telephones of some of the leading manufacturers, 50 cents: any two sets, 80 cents; all three or 41 diagrams, $1.00. These circuits are in great demand and are invaluable to the exchange manager.

THE INTERNATIONAL SPECIALTY COMPANY, Chicago, Ill., is receiving very large orders for its No. 1 telephone and is having all it can do to supply the demand. In the future it is planned to manufacture a complete line of exchange, toll line and intercommunicating private line and desk telephones, but up to this time, owing to the demand for the No. 1 telephone, it has not had an opportunity to put these on the market.

THE CENTRAL ELECTRIC COMPANY of Chicago has published a new discount sheet on its general catalogue, dated September 1, which has been distributed to the general trade. Anyone having a Central Electric Company general catalogue who has not received a discount sheet should notify this company, and a copy of the same will be sent him by return mail. This discount sheet not only covers everything listed in its general catalogue, but contains much new material which has been placed on the market since the publication of the general catalogue.

THE STERLING ELECTRIC COMPANY of Lafayette, Ind., has contracts for switchboards for Coon Bros., Rantoul, Ill., 200 numbers; the Farm and City Telephone Company, Clinton, Ill., 300 numbers; the Lackawanna Telephone Company, Olyphant, Pa., 100 numbers, and is making additional boards for the Johnson County Telephone Company, Iowa City, Iowa, seventh section, and for Racine, Wis., eighth section. The Sterling's Bell style of apparatus is gaining many friends. The company has just put in its new "flashlight" transfer system for the Lafayette (Ind.) Telephone Company's 1,500 drop board, also putting in new style tubular drops. The Rock County Telephone Company, Janesville, Wis., is also having the Sterling Company's "flashlight" transfer system put in. Sterling apparatus is up-to-date and the factory is being worked to its full capacity.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY, Chicago, has just closed a contract to install a complete central battery system of 2,400 lines capacity for the United Telephone and Telegraph Company of Altoona, Pa. The Western is now installing a complete central battery equipment for the Binghamton Telephone Company, Binghamton, N. Y., and shortly will commence the work of equipping the Glens Falls Telephone Company, Glens Falls, N. Y., and the Pan Telephone Company, Fort Smith, Ark., exchanges with the same type of apparatus. Although only recently having removed into its new factory at Winthrop Harbor, Ill., with greatly enlarged factory space and additional machinery, the "Western" has been compelled to increase and work its factory force both day and night in order to keep pace with its large business, which is now the largest in the history of the company.

EUREKA TOLL DESK SWITCHBOARD.

The accompanying illustration shows one of the latest types of switchboards manufactured by the Eureka Electric Company of Chicago. This switchboard is a toll line and chief operator's board and is equipped with the company's new number 9 lever, which is said to surpass anything of the kind in the Independent field. This board is also equipped with the Eureka number 4 tubular drop. All contacts are made on hard rubber of thickness sufficient to stand any strain that may be placed upon the switchboard. Like every piece of Eureka apparatus this board is handsome in appearance. It is also durable and simple in construction.

Within the last few months this company has made quite a number of improvements in its apparatus, particularly in the company's flashlight boards, as well as its central-energy systems and its new number 20 receiver which is furnished on all its telephones. This receiver, together with the company's number 1 transmitter, makes a talking set that is claimed to be unequaled. The resistance of the Eureka transmitter is said to be the highest of any in the Independent field, making it particularly adaptable and especially desired for central-energy work. The company is now furnishing telephones to quite a number of operating companies which originally installed central-energy systems of other makes.

EUREKA TOLL DESK SWITCHBOARD.

NEW TELEPHONE SYSTEM FOR STEAMERS.

The New York and New Jersey Telephone Company has introduced a novel telephone system on the piers of the Hamburg-American and the North German Lloyd Company. Telephone apparatus is placed on the steamers of the company and a station erected on the piers. Connection is made by a flexible cord. By this means telephone communication can be established with incoming steamers before the gang plank is put out. In the case of outgoing steamers passengers can have telephone communication with their friends till the vessel leaves the pier.

TELEPHONE SYSTEM FOR MANHATTAN RAILWAY.

A most interesting feature of the development of the Independent telephone business has shown itself in the contract just placed by the Manhattan Elevated Railway Company of New York City with the Lambert Schmidt Telephone Manufacturing Company, 325 Broadway, New York, for a complete exchange telephone system to be used on the elevated road in New York City. The instruments will be located at the stations and in the offices of the railway company and replace the former telegraph equipment, which has proved itself too antiquated to meet the needs of rapid service. The entire equipment will consist of a 500-line multiple switchboard and telephones, this system being arranged on the common battery type with lamp signals. The conditions of the specifications were necessarily severe, on account of the great number of calls required between the different points for train signaling and otherwise, it being estimated that many of these telephones will be used on an average of 2,000 times a day—practically continuous service. A telephone man can readily appreciate the severe strain such an enormous traffic would have on a common battery system, and the Lambert Schmidt Telephone Manufacturing Company are to be congratulated on satisfying the authorities of the road that their system fully covers the conditions necessary.

It is said the telephone equipment will present many new features and will be a long stride ahead in the telephone art as applied to common battery multiple switchboard systems. An important point in connection with this system is the fact that many of the telephones are located fully ten miles from the exchange center.

The Lambert Schmidt Telephone Manufacturing Company have always stood for high quality of apparatus and are exceptionally pleased at securing this contract on merit alone.

Why don't you subscribe for TELEPHONY, too?

HIPWELL STANDARD BELL STYLE SWITCHBOARD.

The Hipwell Manufacturing Company of Allegheny, Pa., are now prepared to place on the market a telephone exchange switchboard of the type commonly known as the "Standard Bell Style Board," employing drops and jacks mounted in separate groups, manually restored drop shutters, clear out drops connected in the cord circuits and employing listening and ringing keys. The accompanying

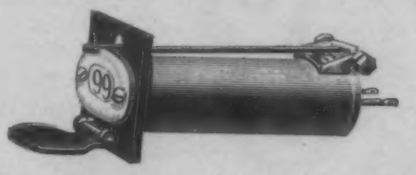
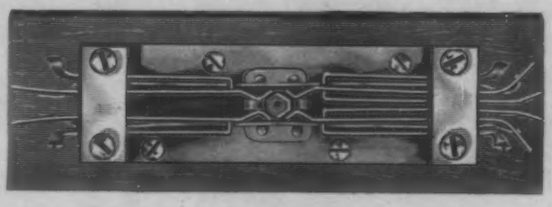


FIG. 1. HIPWELL STANDARD BELL STYLE DROP.

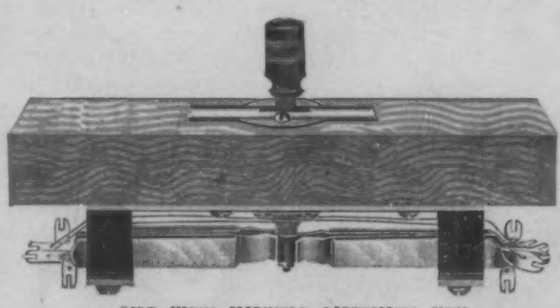
FIG. 2. HIPWELL STANDARD BELL STYLE JACK.

FIG. 3. HIPWELL STANDARD BELL STYLE PLUG.

cut shows the type of drop employed. The coil is inclosed in a tube of softest Swedish iron, making the drop non-inductive; this tube is of sufficient length to allow of insertion of a coil wound not only for series work, but up to a resistance of 1,600 ohms for use in connection with lines equipped with Bridging Bell telephones. This switchboard is made exclusively of metallic circuit type, hence is



BOTTOM VIEW HIPWELL LISTENING KEY.



SIDE VIEW HIPWELL LISTENING KEY.

adapted for connection of complete metallic circuits, common return wire system, grounded lines or a combination of the three. Cut No. 2 shows the spring jack and No. 3 the plug. When the plug is inserted in a spring jack the circuit of the coil wired in connection with the said jack is opened, hence, when connection between any two lines is made, both line drops are cut out of circuit and the clear out drop wired in circuit with the pair of cords employed making the connection is left in circuit; these clear out drops are bridged, hence provision is made for maintenance of the balance of balanced lines which are connected one to another. One of the accompanying cuts shows a side view and one a bottom view of the listening and ringing key employed.

THE MILDE TRANSMITTER.

The Milde transmitter was invented some ten years ago by Milde of Paris, and was used extensively and is to-day through France, Germany, Austria, Great Britain and other foreign countries. It is so constructed that climatic extremes do not effect it. The parts are all permanently placed, and there is no adjustment required. It is claimed by the manufacturers to be the most perfect speaking transmitter on the market. It has good volume, clear and correct reproduction of all sounds. By its peculiar arrangement and material employed as a diaphragm, the voice is said to be more natural when transmitted than through any other transmitter known. About six years ago the Standard

MILDE TRANSMITTER.

Telephone and Electric Company of Madison, Wis., was fortunate enough at the time of its organization to secure control for the exclusive sale of the Milde transmitter in the United States. Every instrument used is imported, and they are all thoroughly tested before leaving France. This company has been uniformly successful with it everywhere. It has been subjected to some of the most severe conditions, and has not met with defeat in competition where given a fair trial. The Standard Company has imported and sold in the United States many hundred thousands of these instruments, and those which went into service six years ago are talking as perfectly to-day as they did at that time.

TELEPHONE MAIL SERVICE.

It is stated that a feature of the postal service not enjoyed by any other city in Michigan has been inaugurated recently in the Saginaw postoffice. It consists simply of a system of collecting and delivering mail in response to telephone calls for such service. Its principal value will be in the delivery of letters in the same city. Mail intended for local delivery may be called for by the messenger and accepted for delivery, provided the postage is prepaid and a special delivery stamp is affixed. Upon receipt of the matter by the messenger he will at once take it to the postoffice, that it may be properly recorded, postmarked and the stamps thereon cancelled, as if mailed at that station, when it will be immediately taken out for delivery to the addressee in the usual manner.

Mail intended for dispatch to other cities may be called for in similar fashion, but two special delivery stamps are needed, one on an outer envelope addressed to the special delivery clerk of the postoffice and another on the inner envelope bearing the proper address of the person to whom the letter is to be delivered. Mail matter intended for dispatch, but not for special delivery at the office of address, may be similarly collected by the special delivery messenger when the letter is inclosed in another to the delivery clerk and a stamp properly affixed. In this case only one special delivery stamp is necessary, but in all cases the payment of the usual two cents postage is necessary in addition to the other stamps.

THE RAPID DEVELOPMENT OF INDEPENDENT TELEPHONY.

(From a paper read at the Owensboro meeting, October 1, 1901, by James Maret, Mt. Vernon, Secretary Kentucky Telephone Association.)

The organization of the Kentucky Telephone Association took place at a meeting held in Crab Orchard on November 2, 1898. The movement was originated by A. H. Bastin and your secretary. Six companies were represented at this gathering. It was necessary for the Independents to get together for the advancement of the business and mutual protection against the monopoly, that had been in possession of the field so long, or suffer destruction at its hands.

At this meeting A. H. Bastin was elected president, James Maret, secretary, and F. P. Cambest, treasurer.

Another meeting took place at S. Asaph Hotel, Stanford, on December 6, 1898.

No other gathering of the association occurred until June 7, 1900, which took place in Winchester with eighteen companies represented. The following officers were elected:

David Prewitt, president, Pine Grove; A. H. Bastin, vice-president, Lancaster; W. W. Longmore, treasurer, Frankfort; James Maret, secretary, Mt. Vernon.

A new constitution was adopted at this meeting, and October 9th of same year was set for next meeting and election, which took place at Winchester, and the following officers were elected:

R. V. Bishop, president, Cynthiana; A. H. Bastin, vice-president, Lancaster; James Maret, secretary and treasurer, Mt. Vernon.

Our constitution was amended. The work continued to improve from this meeting.

Call meetings were held at Lexington on October 23 and December 10, 1900, which gave our cause much encouragement.

On the president's call a meeting took place in the court house, Lexington, June 27 and 28, 1901. Matters of importance were considered and acted upon. This gathering proved to be the most important in the history of the organization.

Owing to conservatism of our people, the association was of slow growth during the first two years of its existence; although the officers, one and all, worked diligently, gave their services willingly and free of charge. It was not in vain, however, for during the third year there has been awakened interests that are solid and substantial, supported by the leading Independent companies, as our roll call will show, and our position to-day is improved over a hundred per cent above last year. The monopoly with its boasted millions, have failed to carry out their threat to exterminate us. It appears now that other people have a little money also, two and a half million invested in Kentucky, and some to spare, not, however, for crushing or exterminating competition, but for using in legitimate purposes in way of extensions, improvements and establishing still better service at reasonable rates. Others with capital are ready to invest in our lines and plants and those we are originating and pushing.

The first conviction, we note for tampering with lines, occurred in the Lancaster Circuit Court, which took place in August. Nick Parks was sentenced to the penitentiary for two years on charge of having broken insulators on the Bastin system between Crab Orchard and Lancaster. Tom Naylor, an accomplice, ran away, forfeiting bail of $300, which his bondsman had to pay.

Deserters from our ranks have been few. Richmond broke its agreement and sold out to the opposition some ten months since. Other companies who were not members, but under contract for exchange of traffic, including Paris, Stanford, Lebanon, Nicholasville, also sold out. A new Independent company at Nicholasville has put in a first-class plant with connections to their neighbors and get most of the business. Some of the other sold out plants will be rebuilt by the Independents.

The rapid increase and extension of new Independent lines and plants and the strengthening and improving the older ones is very satisfactory and offsets many times the effects from desertions.

Five of the plants purchased by the opposition are covered by Section 201 of state constitution, which provides that no telephone company can purchase, lease or operate a competing, or parallel line. Suit has been instituted by Attorney-General Breckinridge to set aside these sales and to declare the charter of the would-be purchasers void. Other suits are under way against them for violation of contracts made by the sell-outs which the purchaser has failed or refused to carry out. In some instances the Cumberland or East Tennessee—whichever they are—continues to give connections according to contracts as they existed when the Independent plants sold out to them.

When they bought out these Independent plants, they placed the name of the monopoly at the head of the exchange directories, but immediately after the above-named suit had been brought they replaced the name of local company they had purchased, on the directories.

As you are more or less acquainted with the tactics of the monopoly it is needless to say more than that, where they cannot crush competition in one way they will find many others, and let me add, few of these ways are clean ones.

Misrepresentation, falsehood and deceit is sown broadcast wherever their field representatives are found. Their managers are a shrewd set and know what tools to send forth to gain their disreputable ends.

The Cumberland's president recently called down a hornet's nest upon his cranium by inserting a column of paid matter in the Courier-Journal in which he greatly praised his monopolistic employers and belittles the Independents. The matter was taken up by several, among them the Lexington Herald, and what was done for Mr. Caldwell's article, and subsequent replies, was highly satisfactory to our people.

It is but justice to mention that the association is under obligations to the state press for their great assistance in our fight for justice. Very few of the newspapers have lent their aid to the monopoly, except at advertising rates. The association is especially indebted to the Morning Herald of Lexington for the noble fight it has waged in our interests.

The long-distance company recently organized in Louisville, of which Mr. Brailey will tell you later on in this meeting, will serve to spike the guns of the enemy and put a stop to their everlasting clatter of "long-distance." We will have long-distance of our own, while in fact to-day our present "long-distance" in the state is as good as theirs, though our mileage is not as large, and our new will be far superior as it will be full copper metallic, giving a fine talking connection with several states besides reaching all principal parts of our own Kentucky.

Old-line companies have two million 'phones in the United States after a quarter of a century's existence, the Independents after less than seven years have three million 'phones in operation and there are to-day 250 manufacturers putting in full time making more. Capitalists no longer hold aloof, but seek to make investment in Independent telephone securities when they can find them for sale.

Ten states to the north and northwest of us have from 426 to 507 exchanges each, Ohio leading, and every state in the Union is at work. Several states have Independent long-distance companies which have solved the problem for which they were established. The United States Telephone Company and the Federal Telephone Company of Cleveland, the New Telephone Company of Indianapolis, being among the number, their capital amounting to $25,000,000. These companies place no 'phones but build long lines and connect up the various exchanges; the local companies have charge of the transaction of business of long-distance work on which they pay a certain per cent to the long-distance companies when their wires are used .

In the conclusion of a paper read at the Lafayette (Ind.) meeting recently by Mr. George Haywood he aptly says:

"There are some few people who always expect others

to bear their burdens; they are very willing that their burdens should be borne by others. Those few people will take advantage of the guerilla methods used by the Bell people and use their telephones because they can get them for less, or for nothing. Others, and the very large majority, with better judgment, are willing to pay a reasonable price for telephone service, and at the same time protect themselves from the future oppression of the Bell people. It is the duty of the managers of every Independent exchange, as well as all toll lines, to supply the people with the very best service. We owe it to ourselves and to the people who stand by us. It is to our interest to give such service because we thereby succeed. We owe it to ourselves and to the people who stand by us to thoroughly organize and stand together, to be faithful and true to each other and to the Independent movement. So long as we do this, we need have no fear, but can rest assured that further and greater success will reward our efforts."

ELECTRICAL WAVE TRANSMISSION.

BY MICHAEL I. PUPIN PH.D.

(Paper read before the Massachusetts Institute of Technology.)

Electrical wave transmission over a wire conductor has a mechanical analogy in wave transmission over flexible cords. The application of a force to one end of a cord develops three reactions—mass, tensional and frictional reactions. The energy used up in overcoming the first two is non-dissipative, i. e., it is stored up in the cord along which it is propagated; whereas, the energy consumed against frictional reaction is wasted as heat. Consequently, if there be sufficient frictional resistance, the wave will not extend far from the point at which the impressed force is applied before the energy imparted to the cord (as kinetic and tensional energy) becomes dissipated as heat. In the case of wave transmission along a cord, it is this dissipative factor which causes the wave attenuation.

Similarly, when an alterating electromotive force acts on an electric circuit, the energy imparted to the wire conductor encounters three reactions—inductance reaction, which is the same in form as the kinetic reaction of a vibrating cord and is non-dissipative, its work being stored up in the system as magnetic energy; capacity reaction, the law of action of which is identical with the law governing the tensional reaction in strings, likewise non-dissipative; resistance reaction, in the overcoming of which heat is generated, therefore it is dissipative. Consequently in electrical wave transmission the energy is continually dissipated as heat on account of the resistance reaction and causes the attenuation which limits telephony over long conductors, particularly over cables.

Evidently, to diminish the attenuation in either of the above cases the non-dissipative factor must be made larger in comparison with the dissipative or frictional reaction, since a relatively smaller dissipation of energy would result. The conclusion is that the transmission over cords must be better through a dense medium, or cord, since the mass reaction is thereby increased.

To illustrate this point, a light cord lying on an inclined rough surface may be set into periodic vibration at one end by a suitable mechanism. Owing to friction, the wave energy on the cord is propagated only a short distance, the attenuation being very marked. On increasing the tension and thereby increasing the tensional reaction, the wave progresses much further. By substituting a cord of larger mass, the distance of the wave propagation may be noticeably increased. With a given cord, if the tension has been increased as far as possible, what may be done to diminish the attenuation? Assuming that a heavier cord cannot be substituted, the effect of a cord of large mass may be secured by loading the cord with sinkers of metal at periodically recurring points. Certain experiments demonstrate clearly and beautifully that the transmission can be much improved in this manner, provided the sinkers are suitably arranged.

The following conclusions were drawn from the above experiments: (1) It is more efficient to transmit energy over a heavy than a light cord. (2) A cord, if periodically loaded, may be made equivalent within any degree of approximation, to a heavier uniform cord. It is to be observed that the distance between consecutive loads must be smaller than the length of the wave which is transmitted.

Similar experiments suggested to the author, in the earlier stages of the research, the manner of attacking the electric problem. In any circuit the magnetic inductance (a source of non-dissipative reaction) is limited. It is well known that coils of wire possess large inductance, consequently such coils should act for an electric circuit in the same way that sinkers do for a cord, and the problem of electrical wave transmission should reduce itself to the placing of inductance coils at proper periodically recurring points on the wire.

In order that such a non-uniform or loaded conductor may act as a uniform conductor of large inductance, it is necessary from mathematical analysis to distribute the loads at periodic distances which are small in comparison with the length of wave which is being propagated.

Since electrical waves in telephony are many miles long, it was impossible to carry out investigations on an actual line. An artificial cable, equivalent to 250 miles of line, was arranged in the laboratory at Columbia University, and inductances were placed at periodically recurring points. The current was measured and the waves plotted for the 250 miles. Using several frequencies the results of measurements were compared with the mathematical theory, and were in splendid agreement.

The practical value of this discovery is: (1) That wave energy for telephony and telegraphy may be transferred over much greater distance. (2) If the distance remain constant it enables wires of smaller size to be used, thus decreasing the cost of installation. (3) With the same weight of wire as in use at present, the distance of transmission may be greatly increased.

In the Atlantic cable, owing to the small magnetic reaction, and also small capacity reaction, the resistance reaction predominates by far, and the dissipation of energy is therefore enormous. By a proper distribution of inductance coils at periodically recurring points, say one-eighth of a mile apart, the inductance reaction can be made very much larger than the resistance reaction for all frequencies which are of importance in telephony, and thus the dissipation diminished to any desired limit. The discovery may, and it is confidently expected that it will, result in the telephonic transmission across the Atlantic.

ON TELEPHONE CLERKS.

In many industrial establishments the art of answering the telephone has been thoroughly learned, but in others it is regrettable to state that this simple matter seems to have escaped attention, and the telephone is put in the hands of an ignorant and often impolite person, says the Electrical Review. No business house would consider for a moment putting at its office entrance any person to receive visitors and answer their questions who was not familiar with the work of the establishment, and who was not polite and willing to extend every possible courtesy to visitors and inquirers. Yet the telephone, which is rapidly coming to be the most important door to the business office, is all too frequently put into the hands of incompetent, impolite and ignorant persons. The matter is one of really great importance. As it progresses and the use of the telephone becomes more general, more and more of the world's business is being done over it and it is becoming constantly more important that the person answering telephone calls should be competent to give correct and intelligent answers and give them politely. No one who is familiar with the general indifference of office boys and such, as experienced over the telephone, will wonder at these remarks. Here is a place for a thorough and far-reaching reform.

EVOLUTION OF INTELLIGENCE TRANSMISSION.

BY HARRY S. COYLE.

The history of the evolution of the transmission of intelligence is really the history of every invention that has ever been devised for this purpose. From the beginning of the art the experimenter has been devising a way by which the forces of nature could be combined so as to bring the whole world into his own environment. The records of past inventions are not all contained in printed books, their history has been graven on tablets of stone, which were written in the picture language by men who used the campfire system of communication. The history of human society is divided into four industrial and social stages: First, the hunter or savage stage; second, the shepherd or barbaric stage; third, the civilized or monarchical stage; fourth, the enlightened or representative stage. During all of these periods man was endeavoring to communicate with his distant fellow. The first efforts to transmit intelligence were made by the sylvan man—by the hunter or savage man—long ago, very long indeed; not very long when compared with the geologic history of the earth, but very long when compared with the printed histories of man.

The night is to the savage what the day is to the civilized man, so the fire brand was adapted as a method for transmitting intelligence. As time passed on from that ancient epoch when men had landed on every shore and isle they slowly improved in their arts, and these improvements led them into an interchange of commodities, and thus was the commerce of the world established. It is here that man abandoned the cave and established small communities of tented villages. This is the shepherd or barbaric stage of society. Man used the campfire signals still, but he uses a marvelous code of signs with it, experience has taught him that he must have a means of communicating instantaneously with every clan and tribe in the nation. So he learns to transmit intelligence by symbols of fire, which consists of waving of fire brand or torch; almost every tribe has a code of signals of its own. In the more advanced periods of barbaric life these codes become a very intricate system. Throughout savagery and barbarism only campfire signals were invented, and these answered all practical purposes when communities were limited to a radius of a few miles. When civilization came to the shores of the Mediterranean cities commenced to dot the prolific feeding grounds, then man saw that it would be wise to invest his rights in one supreme power—the monarch. He also saw that it would be necessary to communicate from city to city, so he invents the semaphore with its wonderful code of signals, by means of the semaphore he was enabled to transmit visual signals from tower to tower. All of the cities of Europe were so connected. The semaphore system is a method of communication peculiar to the monarchical or civilized stage of society. It was a long step from the visual sign to the audible sound method of transmitting intelligence, but the semaphore prepared the way for the telegraph. The visual sign systems of transmitting intelligence were the only methods known to the people of the savage, barbaric and monarchical stages of society. As the light from the fire symbols showed the way for the semaphore, so the visual sign system of the semaphore prepared the way for the audible sound of the telegraph, which in turn gave birth to the telephone.

It is not possible to measure the time in years that it has taken to accomplish this grand evolution from the campfire signal to the electric method of transmitting intelligence. When the art of telegraphy was first put into practice man thought that it would be necessary to receive his messages by visual signs, as he had always done in past ages. The inventor himself made no provisions for receiving sound audibly, all thought that it was impossible to interpret the message by sound. So we have the long and short lines of the Morse code corresponding to the movements of the semaphore, and to the torchlight in the hands of the savage. However, it did not take man long to learn that it was possible to interpret the messages by the sounds of the instrument, and thus was another step taken toward the invention of the telephone which affords the direct means for the transmission of intelligence. The campfire signals grew into the semaphore and the semaphore grew into the telegraph, and the telegraph grew into the telephone, and the process is not yet completed, for the old inventions clothe themselves with the garments of the new and rush on to new purposes; the inferior is transformed into the superior, and the good is made better, and the better is made the best. It was 2,500 years ago since Thales, the Milesean, who was one of the seven wise men that founded the Ionic Philosophy, and divided the year into 365 days, made the first recorded observation on the electrical properties of amber, and later on Wolimer, King of the Goths, "emitted sparks from his own body." From that remote period to 1600 A. D. very little progress was made in the electrical science. In that year William Gilbert, an English physician, published his famous researches on the magnet and the electrical experiments pursued in his studies.

At the dawn of the age of enlightenment—the age of representative government—the whole world was thrown into a ferment of political and scientific activity. The names of Volta, Galvani, Franklin and a host of others are famous for the great works they performed in this period.

M. Charles Boursenl published his famous theory of the electrical transmission of intelligence in 1854. This curious speculation appeared like other great events which have so often casted their shadows before them.

The progress of the world depends upon the inventions of the practical man. Philip Reis of Germany applied Boursenl's theory to an ingenious invention in 1861, which was partially successful. This invention consists of a combination of Page's vibrations and Scott's phonantograph.

After an elapse of sixteen years Bell took up the question and succeeded in transmitting speech to quite a distance.

It would be a long but a beautiful story to tell what part Gray, Varley, Dolbear, Hughes, Edison, Blake and a host of others, whose names are immortal, performed in this evolution from chaos to symmetry. Coming to our own time, we find the experimental field more active than ever, and the march to the patent office represents the wonderful progress that is being made in the arts and sciences, especially in electricity. Every telephone shop in the land has some sort of an experimental laboratory. There are several experimental telephonic laboratories in this country which have won a world-wide reputation, and have placed this country far in advance of all other nations in the manufacture of telephonic apparatus. The work performed at these institutions represents most of the progress that has been made in the perfection of telephonic inventions. The important results to be derived from the application of experimental methods to the art of telephony has been demonstrated most signally in independent telephone circles. Experiment has made this country famous for its advanced ideas in electrical apparatus. Experimentation is the meeting ground of most of the arts and sciences; it is here where scientific men meet and discuss their theories, and, as Darwin said, "Seek to close a path toward error, and possibly open the road to truth."

By the co-ordinate and contemporaneous improvements of all of the systems of the transmission of intelligence known to early men, and the gradual evolution of these inventions through a long period of experimentation which has carried the experimenters through many fields of inquiry, we have as the sum total the telephone, which represents the transmission of intelligence as performed in the age of enlightenment—the period of representative government.

Will there be a new method of transmitting intelligence for the future? Science answers "Yes." Even now we hear mystic murmurs that come from the state of unrest which surrounds telephony. With the earth connected from end to end, it will not only be possible to transmit speech, but sight as well. Then, indeed, shall the barriers of environment be removed forever.

THE KENTUCKY TELEPHONE CONVENTION.

At the convention of the Kentucky Telephone Association, held at Owensboro, Ky., October 1 and 2, the following officers were elected for the ensuing year: President, H. V. Bishop of Cynthiana; vice-president, H. K. Cole of Owensboro; secretary and treasurer, James Maret of Mt. Sterling.

The next place of meeting was left with the executive committee.

The following telephone companies were represented in the meeting:

Louisville Home Telephone Company, J. A. Armstrong and W. C. Polk.

Independent Long Distance Telephone & Telegraph Company, Louisville, J. C. Zeluff.

Central Construction Company, James S. Brailey, Jr.

Fayette Home Telephone Company, Francis Douglas.

Winchester Telephone Company, D. L. Pendleton.

Mt. Sterling Telephone Company, S. T. Prewitt.

Old Kentucky Telephone & Telegraph Company, David Prewitt.

Maysville Telephone Company, D. L. Pendleton.

Cynthiana Telephone Company, R. V. Bishop.

Lancaster Telephone Company, A. H. Bastain.

Frankfort Telephone Company, W. W. Longmoor.

Versailles Telephone Company, James S. Brailey, Jr.

Hancock Telephone Company, W. E. Ford.

Harrison Telephone Company, H. K. Cole, J. W. Slaughter.

Nicholasville Telephone Company, D. M. Murphy.

Henderson Telephone & Telegraph Company, James R. Rash.

Green River Telephone & Telegraph Company, H. R. Donovan.

Morganfield Telephone Company, J. K. Waller and J. R. Lamie.

Uniontown Telephone Company, C. P. Cissell.

Hartford Telephone Company, J. M. Mattingly.

Fordsville Harrison Telephone Company, E. W. Ford.

Slaughtersville Telephone Company, Mr. Ogden.

Mr. H. K. Cole of Owensboro read an interesting and instructive paper on "Exchange Service." His treatment of the subject showed a deep knowledge of the manner in which local exchanges should be best managed from the standpoint of economy and good service to the subscribers.

Mr. J. S. Brailey, general manager for the Central Construction Company, which is putting in the new exchange in Louisville, then read a paper on "Long Distance." He laid particular stress on the long distance connections being made by the Kentucky and Indiana independent telephone companies and stated that within the next few months this work would be completed and nearly all of the principal towns and cities of the state will be connected by competing lines. The initial line is between Louisville and Lexington, and lines will now be built from Louisville to Owensboro, Indianapolis and other points.

Mr. J. W. Carter, in behalf of the local company, delivered the closing address.

At the banquet Mr. E. W. Smith was toastmaster. Mr. W. A. Douglas of Lexington spoke on "Developments of the Independent Movement at Lexington and in the Bluegrass." Mr. W. W. Clark responded to the toast of "Yellow Banks on the Ohio." Mr. James H. Parrish made a brief and pointed talk. Mr. J. E. Zeluff of Louisville spoke on "The General Progress of the Independent Movement." Mr. J. K. Waller spoke on the "Possibilities of the Independents in Western Kentucky."

The Fall River Automatic Telephone Company has commenced operating its exchange with a portion of its subscribers and is adding to the number as fast as telephones can be put in and connected by the present gang.

New applications for the automatic service are coming in freely on account of the satisfaction given. The Strowger automatic telephone system is used, the same system as that installed in New Bedford some months ago, but with important improvements.

SOUTHEASTERN IOWA CONVENTION.

The third annual meeting of the Southeastern Iowa Independent Telephone Association was held at Ottumwa. Questions which are vexing to independent telephone managers were discussed.

Officers were elected for the ensuing year, as follows: President, C. B. Doble, Sigourney; vice-president, J. C. Thorn, Fairfield; secretary-treasurer, C. M. McFattridge, Moravia. Executive committee: H. E. Pancost, Ottumwa; W. D. Densmore, Oskaloosa; W. H. Fowler, Pella.

The association decided to hold the next annual meeting at Oskaloosa, the second Tuesday in October, 1902.

Addresses were made on the following subjects by the men indicated:

"Methods of Bookkeeping and Reporting for Toll Lines," H. E. Pancost, Ottumwa.

"Mode of Connecting Instruments on Toll Lines," L. C. Morrison, Ottumwa.

"Toll-Line Switchboards and Connection with Lines," W. D. Dunsmore, Oskaloosa.

"Iowa Laws and the Mode of Taxation, with Illustrations as to Property Owned by Exchanges Operating Toll Lines," H. C. Raney, Fairfield.

"How Should Toll Lines Connect with Farmers' Lines?" C. B. Doble, Sigourney.

"Should Non-Subscribers Be Allowed to Use Instruments?" W. H. Fowler, Pella.

"What Can Be Done to Further the Interests of the Independent Telephone Companies?" Dr. H. C. Herr, Cleveland, Ohio.

Dr. Herr is connected with the Ottumwa Telephone Company. His address was on a subject which is one of importance to all telephone men, more so probably than any of the other topics which were handled. He is experienced in financial matters and in the telephone business, and his advice was listened to attentively. He advocated first of all a unity of purpose among the various companies of the association, saying that the sooner petty difficulties are lost sight of the sooner real success will crown the efforts of the companies affected. He advised the telephone men to educate the people, especially in the outlying districts and in the country, to realize the utility of the telephone, and to bring them to a stage where they could not do without an instrument in their homes or business houses.

Dr. Herr said that the age of the telephone has not yet reached its prime. He said that the people are only becoming awakened, and are just beginning to realize the benefits of the toll lines. He cited the fact that telephone company securities are looked upon by financiers as in the "preferred class," an indication that the telephone is a good investm and that there is something ahead of it. He made a special plea for the use of good instruments and good lines.

LEGALITY OF TELEPHONE OATH.

An affidavit by telephone, taken by a justice or notary, is legal, according to Judge Burke, of the Circuit Court at Baltimore, who, on September 11, gave his decision to that effect in the case of the petition of the Manor Lumber Company of Baltimore county, asking for the revision of an order appointing Osborne I. Yellott receiver for the concern. When Mr. Yellott was ready to file the necessary papers asking for a receiver, he had Mr. Cross come to the telephone at Cincinnati, and Justice Thomas Butler, who knows Mr. Cross very well, took his affidavit to the bill. The contention was made by the attorney for the company that affidavits taken in the manner described are not legal and bona fide.

DEPRECIATION OF PLANT.

(Abstract of a paper read by Mr. George Wilkinson before the Illinois Association of Public Accountants at Chicago.)

The charge to be made against the earnings of a telephone company, with respect to depreciation upon its plant, should, in my opinion, be at the rate of 10 per cent per annum on the average amount of plant in use throughout the year, based on the actual cost of construction.

This charge for depreciation is separate and distinct from the charge for current repairs and maintenance, and is made to provide against the inevitable decay of the plant and the superannuation of the equipment.

Telephone companies, in all large cities, have, during the last two or three years, put in, or are now putting in, entirely new, modern and highly improved switchboards, manufactured especially for their requirements at enormous cost. These are provided with one common battery, situated at the central office, which displaces the old individual batteries in the subscribers' offices or residences, with which we used to be so familiar, and which were constantly in need of inspection at the hands of an unwelcome lineman.

The removal of the receiver from its hook by the subscriber calls the attention of the switchboard operator, by illuminating a small electric lamp on the switchboard, in connection with the particular subscriber's plug socket. This device has earned the name of the "visual signal switchboard."

This highly improved switchboard is the latest thing of its kind that is known to the art of telephony to-day; but who is prepared to say that it will so remain ten years?

Nor is the advance of modern science, as applied to the company's own business, the only factor that affects the question of depreciation. Ten or fifteen years ago, when telephones were comparatively little used, a single iron wire grounded line rendered efficient service in large cities, but the advent of trolley cars, the multiplication of overhead electric currents and the ravages of electrolysis have compelled the telephone companies to install insulated double copper wires throughout their systems, in order to secure the greater conductivity necessitated by the interference of other modern business.

From the minute you set up a creosoted pine pole in the ground, load it with cross arms and glass insulators and string thereupon copper wires, a process of decay in all parts sets in, which is as sure as death. From the minute you build brick manholes and lay wooden conduits in the ground and pull through them leaden pipe, filled with insulated telephone wire cable, a process of disintegration sets in, which will, all too soon, eat up the entire construction.

The rapid advance in the science of telephony is constantly throwing out apparatus—switchboards, batteries, transmitters, receivers, lightning arresters and all the rest, that have become antiquated.

In the examination of the books and records of a large telephone company doing business in several of the Southern States last summer, there were brought to light certain facts, which seemed to me to eliminate a great deal of controversy on this much discussed question of depreciation, as applied to telephone plants, and to afford a specific basis for calculation.

First, as to the decay of the plant. The great Southern Company built a telephone plant in New Orleans from 1883 to 1885. In 1899 this telephone plant was scrap. With the exception of a couple of hundred old sixty-foot cedar poles, which, from their great stature, claimed much regard from the rebuilding contractors, not a stick nor a string of the original plant remains in service to-day. This demonstrates that the life of that part of a telephone plant that is out of doors (in New Orleans) is from 12 to 15 years.

By reason of the great humidity of the air in the Crescent City, the level of whose streets is some seven feet below the Mississippi River, and whose soil is supersaturated with filthy water rising within a foot of the cobble stones, the decay and consequent depreciation of such a plant is unquestionably more than it would be in a dry city like Chicago. But allowing for this, I should estimate the life of the outdoor plant of telephone and telegraph companies at from 15 to 17 years.

Then as to the superannuation of the equipment; the main item of equipment in a telephone exchange is the switchboard; all the minor parts and implements are shorter lived. The average life of a switchboard in a large city was determined in the case of the examination previously referred to. The switchboard in Memphis was installed in 1888 and was taken out and thrown away in 1900. The switchboard in Nashville was installed in 1885 and came to an end in 1900, while the New Orleans board, installed in 1884, was taken out in 1898.

In each case the switchboard was taken out because its usefulness was at an end. Without being absolutely worn out from actual use, it had to give way to a more modern apparatus installed at enormous cost. In each case the old switchboard and all its wiring and accoutrements were so much junk, fit only for the scrap heap. These facts seem to fix the life of a switchboard, and all its contributory equipment, at from 12 to 14 years.

In the absence of an annual charge against the earnings for depreciation, a telephone company would be unprepared to meet the large expense of replacing a switchboard, costing $46,000 for 3,300 circuits, out of the earnings for the year such replacement was made, but, on the other hand, a company that has made a regular annual charge against the earnings of 10 per cent on the cost of the plant, will, in fifteen years, have provided a fund out of which the entire plant, by that time ready for the scrap heap, can be rebuilt.

TELEPHONY IN THE CITIES.

Some statistics emanating from Boston go to show that in point of telephone development San Francisco towers above the rest of the cities with a telephone for every sixteen of its population. Estimating five persons to a family, every third family has a telephone. Boston takes second place in this development, with a telephone for every twenty-four inhabitants, or one telephone for every five families. Philadelphia shows the largest relative gain in the number of telephones in use, with an increase of 63 per cent over the year ended December 31, 1899, Louisville coming next in the order with a gain of 43 per cent. The number of calls per subscriber is not given, however. The telephone situation in some of the larger cities in the United States is given as follows:

City.	Telephones, Dec. 31, 1899.	Telephones, Dec. 31, 1900.	Per cent of.	Population census 1900.	Population per telephone.
New York (all boroughs)	53,128	70,870	33.	3,437,202	48
Buffalo	5,107	6,639	30.	352,219	53
San Francisco	16,817	21,324	27.	342,782	16
Boston	19,905	23,780	19.	560,892	24
Minneapolis	6,210	8,038	29.	202,718	25
Cleveland	13,158	14,570	11.	381,768	26
Detroit	7,434	10,190	37.	285,704	28
Milwaukee	6,893	8,492	23.	285,315	33
Pittsburg	7,409	9,129	24.	321,616	35
Cincinnati	7,161	9,142	28.	325,902	35
Louisville	3,539	5,049	43.	204,731	41
Newark	3,701	4,434	19.	246,070	55
Washington	3,278	4,650	42.	278,718	60
Chicago	21,237	27,734	31.	1,698,575	61
New Orleans	3,274	4,415	35.	287,104	65
St. Louis	6,369	7,512	18.	575,238	76
Baltimore	5,340	6,250	17.	508,957	81
Brooklyn	10,379	13,366	28.	1,166,582	87
Philadelphia	8,268	13,451	63.	1,293,697	96
Jersey City	1,607	1,906	18.	206,433	108

Want Advertisements.

Want advertisements not exceeding twenty words, exclusive of address, will be inserted in these columns for $1.00 each. If over twenty words the rate will be five cents per word.

WANTED—To buy a telephone system, want place to build an exchange, will give reasonable compensation to party for sending name of town. Might purchase interest in exchange if superintendent is needed. Address "F. E. B." care Telephony.

WANTED—To buy second-hand telephone apparatus of every kind. Give price, description and condition of apparatus. Address "BUYER," care Telephony.

WANTED—Franchises for complete telephone plants or toll lines to build own, operate, buy or sell. Correspondence solicited with those wanting Independent telephone exchanges installed in their cities. Address "INVESTMENT," care Telephony.

A TELEPHONE manufacturer desires lowest prices on receivers and magneto bells. Use this method of advertising for reason that do not desire name known in this connection. Address MANUFACTURER, care Telephony.

FOR SALE—One of the finest Orange Groves in Florida, Lake Front, containing 22¾ acres, 1,200 trees. Price $1,500. Address "W. H. S." care Telephony.

FOR SALE—I have for sale several hundred telephones very little used which I will sell cheap. Address "TELEPHONE," care Telephony.

FOR SALE—Second-hand Telephones and Switchboards of various makes, low prices. Address "SALESMAN," care Telephony.

TELEPHONE CABLES

Represent such heavy **FIRST COST** that it is real economy to test them carefully at frequent intervals.

The Leeds Portable Testing Set.

A compact instrument for Wheatstone, Bridge Tests, Etc.

Ask for Descriptive Pamphlet 340.

FOR THIS WORK

THE FISHER CABLE TESTING SETS

are highly endorsed by expert telephone engineers, and are used by some of the largest Independent companies in America.

They are described in detail in **Pamphlet 360,** which will be mailed free to any engineer who mentions this ad.

Also Portable Testing Batteries, Portable Magnetos, Telephone Condensers, Weston Ammeters and Voltmeters, and other High-grade Electrical Measuring Instruments.

JAMES G. BIDDLE,

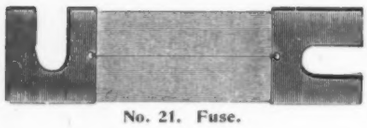
1021 Stephen Girard Building, *PHILADELPHIA.*

YELLOW PINE CROSS ARMS

We are manufacturing cross arms from the high grade long leaf yellow pine of central Mississippi and our shipping facilities are the best in the state. You will find both prices and goods right. Write us.

Brownlee Lumber Co., Meridian, Miss.

A FEW OF OUR SPECIALTIES!



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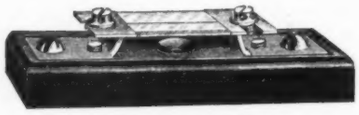

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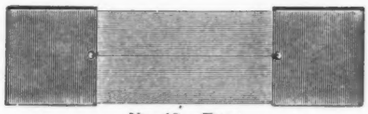

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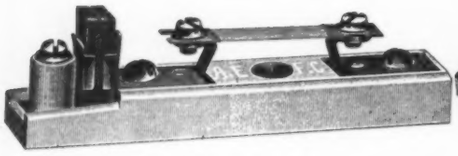

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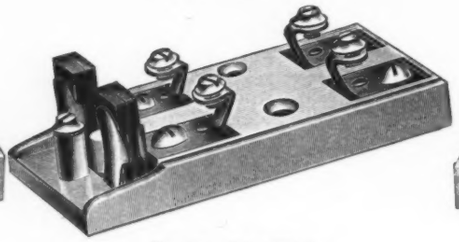

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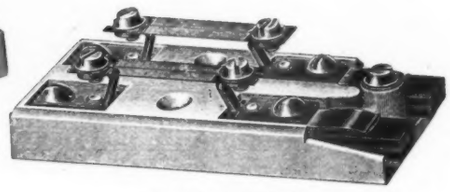

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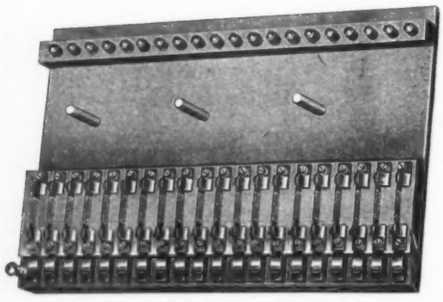
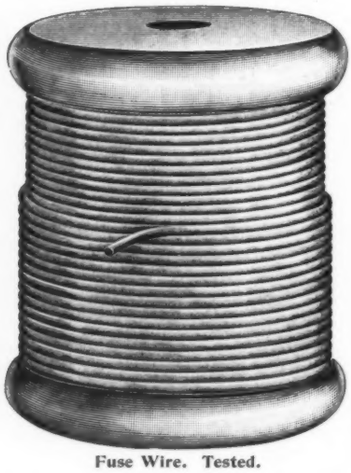
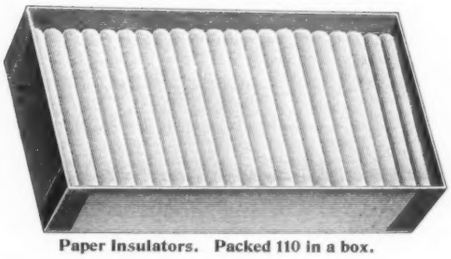


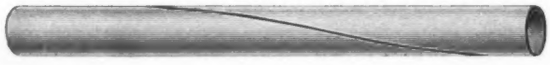
No. 13. Distributing Board.



Fuse Wire. Tested.



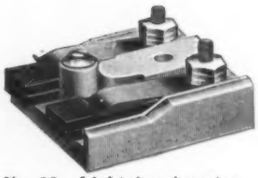
Paper Insulators. Packed 110 in a box.



Paper Insulator.

Wire Joint Twisted.

Wire Joint.



No. 99. Lightning Arrester.

WE CARRY A COMPLETE STOCK.

OUR PRICES ARE THE LOWEST.

No. 23. Lightning Arrester.

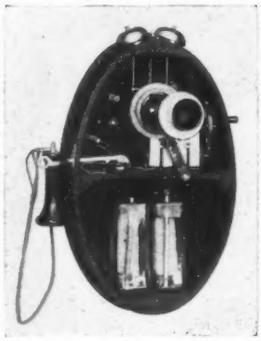
AMERICAN ELECTRIC FUSE COMPANY,

110-116 Nassau Street,
NEW YORK.

345-347 S. Canal Street,
CHICAGO.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

No. 1. Complete.



No. 1. With Lid Removed.

PATENT APPLIED FOR.

THE ONLY

TELEPHONE

Without Hinged or Flexible Wire Connections.

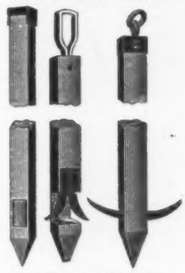
The Strongest Telephone Made

SOLDERED JOINTS.
PLATINUM SWITCHPOINTS.

A PERFECT NSTRUMENT.

Bull-Dog Guy Anchors

THAT HOLD TELEPHONE LINES.



Patent Applied For.

Used in any soil.
Roots and stones no obstruction.
Set in five minutes.
No puddling or tamping.

Country Home Telephone Mfg. Co.

SUITE 808, 135 ADAMS STREET, CHICAGO.

H-P INSULATED BRIDLE OR DISTRIBUTING RINGS FOR TELEPHONE WIRES.

Cat. No. 3580.
Approximate Full Size.

Made of best quality of iron, heavily coated with tough glass enamel. Are readily screwed by hand, and without tools, into the most difficult and out of the way positions. When desired can be unscrewed and used in other places indefinitely. Wires are easily inserted and removed at the opening on the side without injury to either themselves or the Rings. These Insulators are approved and being used by the largest Bell Telephone Companies.

Cat. No. **3580.** (Style A) H-P Insulated Bridle Rings, 1 5/8 in. eye, 1/4 in. opening, 1 1/4 in. shank .....each, **$0.08**

Cat. No. **3780.** (Style B) H-P Insulated Bridle Rings, 1 5/8 in. eye, 1/4 in. opening, 7/8 in. shank.....each, **0.08**

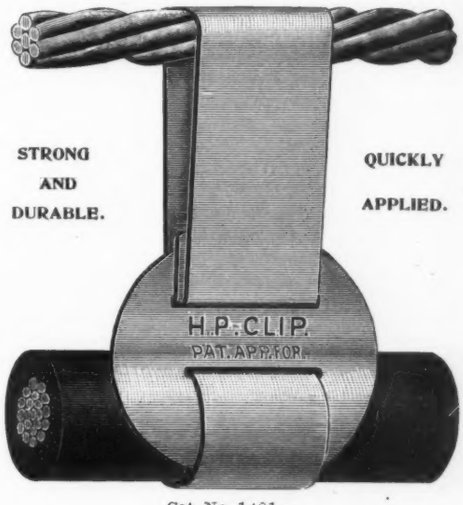
Cat. No **3980.** (Style C) H-P Insulated Bridle Rings, 1 1/4 in. eye, 1/4 in. opening, 1 1/4 in. shank .....each, **0.08**

Cat. No. **4380.** (Style D) H-P Insulated Bridle Rings, 1 1/4 in. eye, 1/4 in. opening, 7/8 in. shank .....each, **0.08**

Cat. No. **4580.** (Style E) H-P Insulated Bridle Rings, 5/8 in. eye, 3/16 in. opening, 7/8 in. shank .....each, **0.05**

Special designs for switchboard use, with machine screw thread, made promptly to order at about same prices in quantities.

H-P CABLE CLIP.



Cat. No. 1481.

These Clips are of one piece of zinc. They grip tightly, not allowing the cable to slip.

Cat. No. **1481.** Price.....each, **2c.**

Write for special price on quantity.

JAMES S. BARRON & CO., Manufacturers,

24-30 Hudson St. and 160-162 Duane St., NEW YORK.

WE ARE HEADQUARTERS

—FOR—

Telephone Cables,
Telephone Wires,
Telephone Supplies,
Construction Material.

WE CARRY A COMPLETE STOCK AND CAN MAKE PROMPT SHIPMENTS.

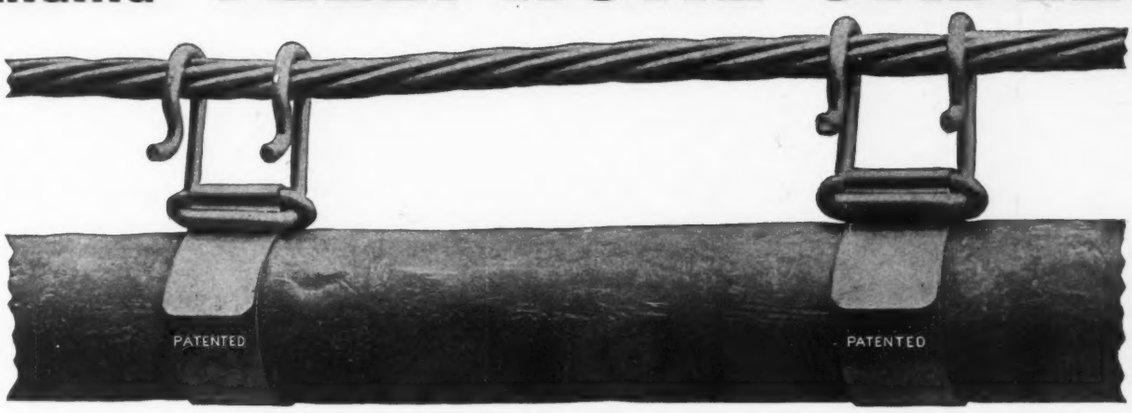
Write Us for Our Catalogue and Prices.

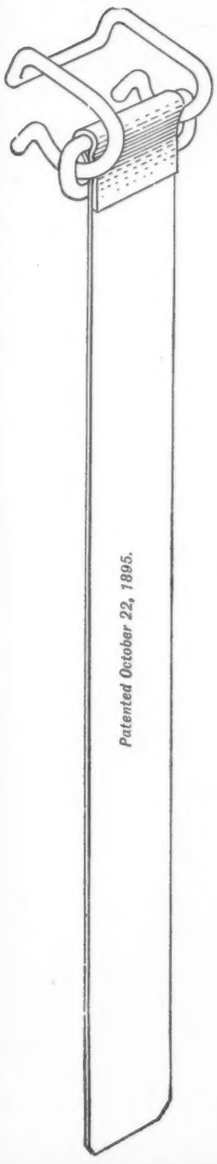
M. B. AUSTIN & CO., 56 and 58 W. Van Buren St., CHICAGO.

WHEN you write to the advertiser will you be kind enough to tell him that you saw his advertisement in TELEPHONY. He will appreciate it and so will we.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

FOR..... HANGING TELEPHONE CABLES





Why don't YOU use

THE "Boston Cable Clip" *TOO?*

The largest Telephone Systems in the country are using them EXCLUSIVELY,

BECAUSE

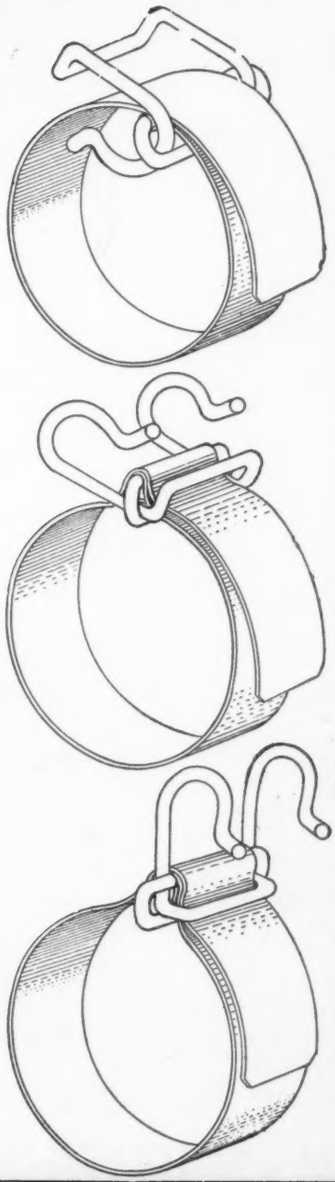
They are the most ECONOMICAL.
They are the most DURABLE.
They are the most EFFICIENT.

BECAUSE

They WILL NOT SLIP.
They are **ADJUSTABLE TO ANY SIZE CABLE.**

MILLIONS IN USE.

LET US TELL YOU ABOUT THEM.



CHASE-SHAWMUT CO.

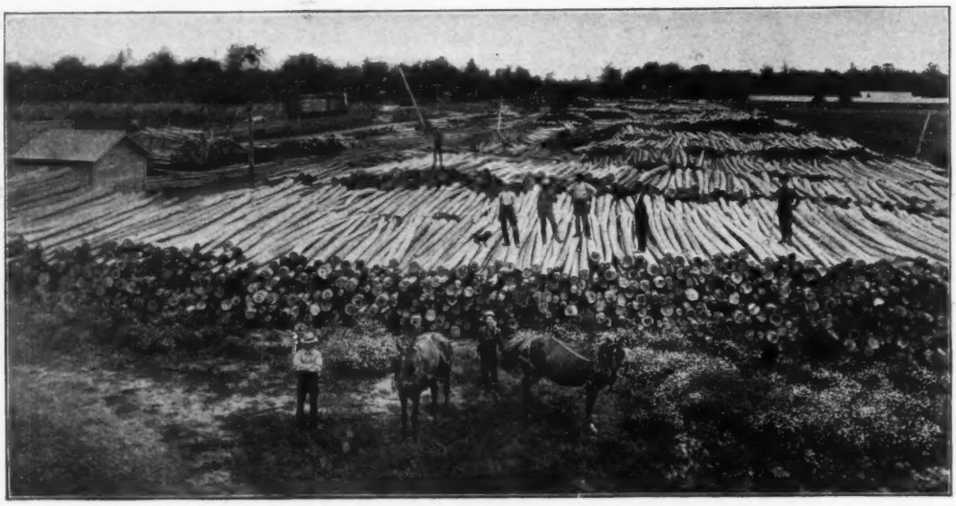
(SOLE MANUFACTURERS)

Boston, Mass.

MACOMBER & WHYTE, Western Agents, Chicago, Ill.

CEDAR POLES

CEDAR POLES



CEDAR POLES

THE VALENTINE-CLARK CO.,

234 LA SALLE ST., CHICAGO.

YARDS: GREEN BAY, WIS. NEW LONDON, WIS

YARDS: PRENTICE, WIS. PINCONNING, MICH.

WM. MUELLER COMPANY, CHICAGO, ILL. **CEDAR POLES.**

YARDS: Metropolitan, Mich., Raber, Mich., Chicago, Ill., Spalding, Mich., Flat Rock, Mich.

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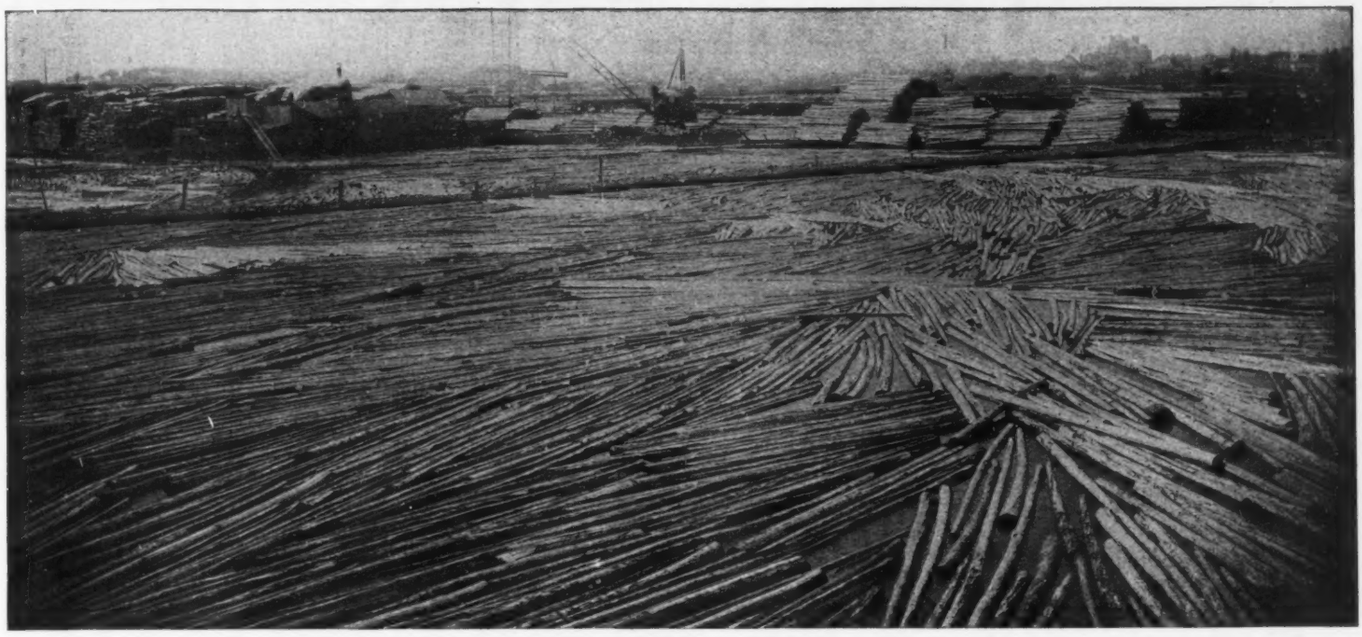
CEDAR POLES



RABER & WATSON, 293 Dearborn Street, CHICAGO.
YARDS: Chicago, Ill., Menominee and Cheboygan, Mich.

A. P. HOPKINS & Co.

ESCANABA, MICH.

CEDAR POLES

BEST POLES.
PROMPT SHIPMENTS.
FAIR PRICES. WRITE US.

JOHN H. FOWLER
FISHER BUILDING,
CHICAGO.
CEDAR POLES
LARGE STOCK.
PROMPT SHIPMENTS.
LONG POLES A SPECIALTY.

WE HAVE 30,000 POLES
In stock ready for IMMEDIATE SHIPMENTS. All sizes 5 in. 20 ft. Poles and larger, quick delivery from our Central Yards. Eleventh year in the Pole business.
O. W. SMITH, Temple Court Building, CHICAGO.

CEDAR POLES, TIES, POSTS, ETC.
Prompt Shipment. Any Quantity. Right Prices. Allow us to quote you.
THE PORTER-MORSE CO., "Producers".
PRINCIPAL OFFICES:
Saginaw, Michigan.

W. C. STERLING & SON,
MONROE, MICH.
11 POLE YARDS IN MICHIGAN.
WHOLESALE PRODUCERS FOR 20 YEARS.
CEDAR POLES

Cedar
Lindsley Brothers Company
MENOMINEE, MICH.
YARDS:
Menominee, Mich. Stephenson, Mich.
Goll, Wis. Portland, Ore.
Poles

J. C. HUEBEL & CO.,
MENOMINEE, MICH.
OUR STOCK OF POLES IS COMPLETE.
MAIN YARD AT
MENOMINEE.
BRANCH YARDS AT
WAUSAUKEE AND PACKARD, WIS.
NATHAN AND BAGLEY, MICH.

TELEPHONE POLES
FIRST-CLASS STOCK;
LARGE ASSORTMENT.
WRITE FOR PRICES.
F. N. CARROLL, TRAVERSE CITY, MICH.

CEDAR
PITTSBURG & LAKE SUPERIOR IRON CO.,
PRODUCERS AND WHOLESALERS,
ESCANABA, - - - MICH.
POLES

STOMBAUGH GUY ANCHORS

ARE PAST THE
EXPERIMENTAL STAGE.
THEY ARE NOW
A STAPLE ARTICLE.

ALL
"UP-TO-THE-HOUR"
TELEPHONE COMPANIES
ARE USING THEM.

Your Supply Dealer Will Furnish Them.

THEY ARE
INEXPENSIVE.

Write us for Particulars and Prices.

W. N. MATTHEWS & BRO.
DISTRIBUTORS
505 Carleton Bldg., ST. LOUIS.

THE WRENCH
MUST NOT BE FORGOTTEN WHEN ORDERING
351R, 502R AND 603R.

CEDAR POLES

We should be pleased to make you a price on some very fine 25 foot 5 and 6 inch top Michigan white cedar poles, also 30 foot 7 inch poplar.

Orders Filled Promptly in Carload Lots. Correspondence Solicited.

Kellogg Switchboard & Supply Co.,
239 So. Green Street, CHICAGO.

CEDAR POLES

I HAVE IN STOCK FOR IMMEDIATE SHIPMENT.

300	7-inch		25-foot	Cedar	Poles	at	- -	$1.20
300	6 "		25 "	"	"	"	- -	1.10
400	5 "		25 "	"	"	"	- -	.70

F. O. B., CHICAGO.

The stock will not last long at these prices. You had better order to-day.

F. E. BELL, **DES PLAINES, ILL.**

POLES

25, 30, 35 foot, 6 and 7 inch top. On these we are especially strong, although we have a full stock of all the standard sizes.

All that is necessary is to write us, our prices and the general good treatment you always get will do the rest. The first order makes you our steady customer. Try us on the next carload.

MALTBY LUMBER CO., BAY CITY, MICH.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

NOW READY!

Telephony's Manufacturers' Mailing List of Telephone Buyers

IN THE UNITED STATES, CANADA, MEXICO AND FOREIGN COUNTRIES.

This List is used by the leading Telephone Manufacturers, Supply Houses, Pole Dealers, etc., and is the only complete list extant.

It aggregates nearly 10,000 buyers, is classified and alphabetically arranged by states and towns in states. It is "THE ONLY ONE."

THE LIST EMBRACES

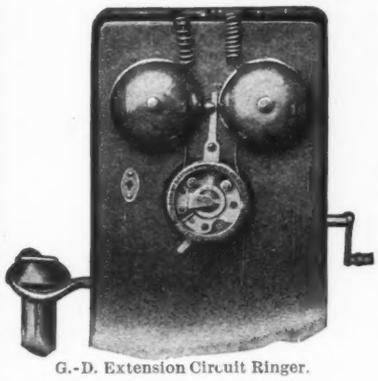
The Independent Telephone Exchanges, Private Exchanges, Principal Toll Line Companies, Construction Companies, Individual Buyers, Supply Houses, Superintendents of Telegraph, Etc.

ADDRESS

TELEPHONY, MANHATTAN BUILDING, CHICAGO, ILL., U. S. A.

THE G.-D. EXTENSION CIRCUIT DEVICES

Made in two styles as shown herewith. The "Ringers" being automatic, requiring no resetting, and the "closers," being the same as the ordinary magnetic drop shutter devices, but cheaper. . . . . .



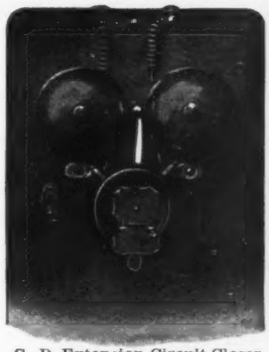
G.-D. Extension Circuit Ringer.

They are mounted on the front of a magneto, and the movement of the bell clapper actuates them, closing an extension battery circuit, ringing a bell at a distance.

The Ringers are in big demand for use on party lines, as they reproduce the exact signal of the magnets and require no resetting.

They will do your work to your satisfaction. Order a sample, as below, and if not O. K. we will return your money.

ASK FOR DESCRIPTIVE PAMPHLET No. T-30, AND PRICES.



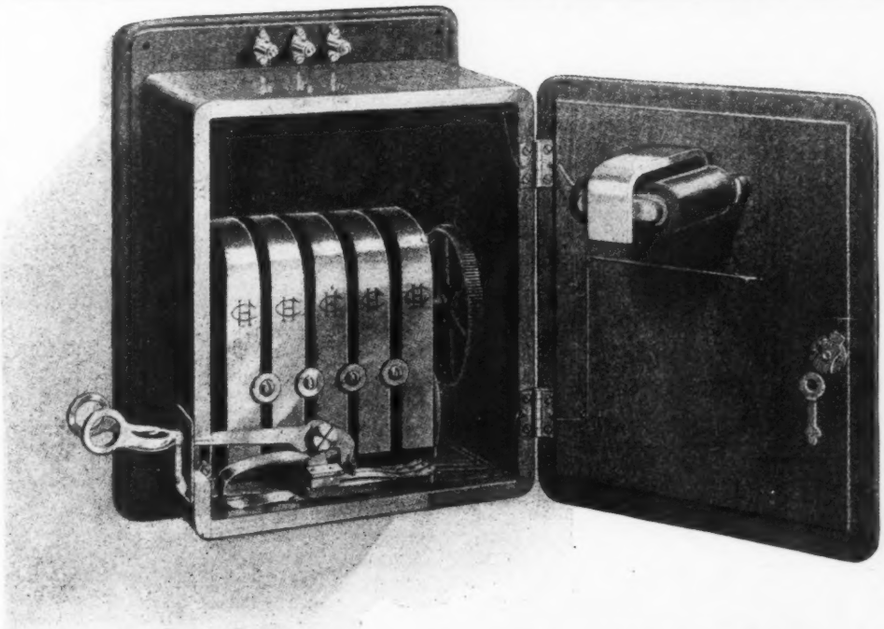
G.-D. Extension Circuit Closer.

WE WILL SEND one sample Ringer as shown above, on receipt of $1.00 postpaid. Cash with order to secure price.

GARTON-DANIELS CO.,
KEOKUK, IOWA.

WE WILL SEND one sample Closer as shown above, on receipt of 50c. Cash with order to secure price.

H-C GENERATORS



NEVER DISAPPOINT

You Know It.

Your Customers Know It.

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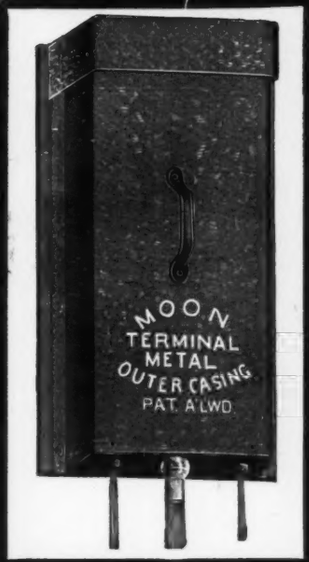

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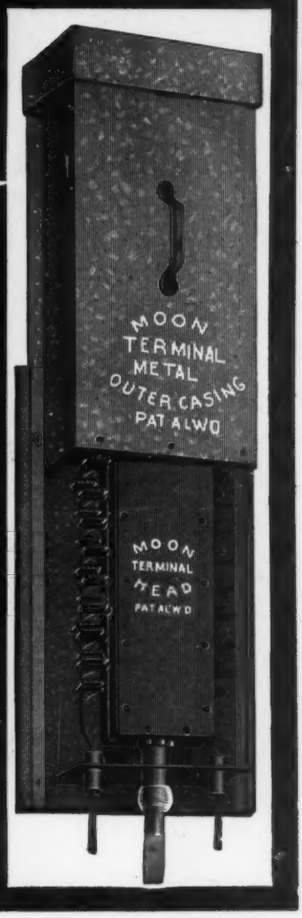

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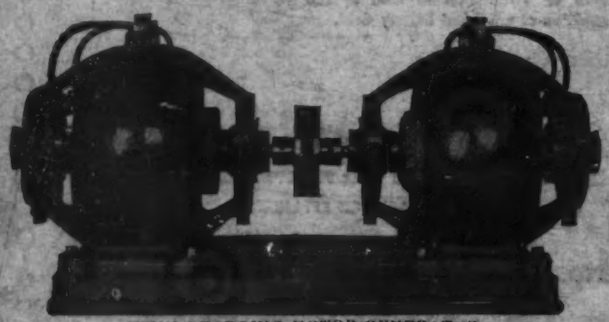

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